

PUBLIC WORKS

City, County and State

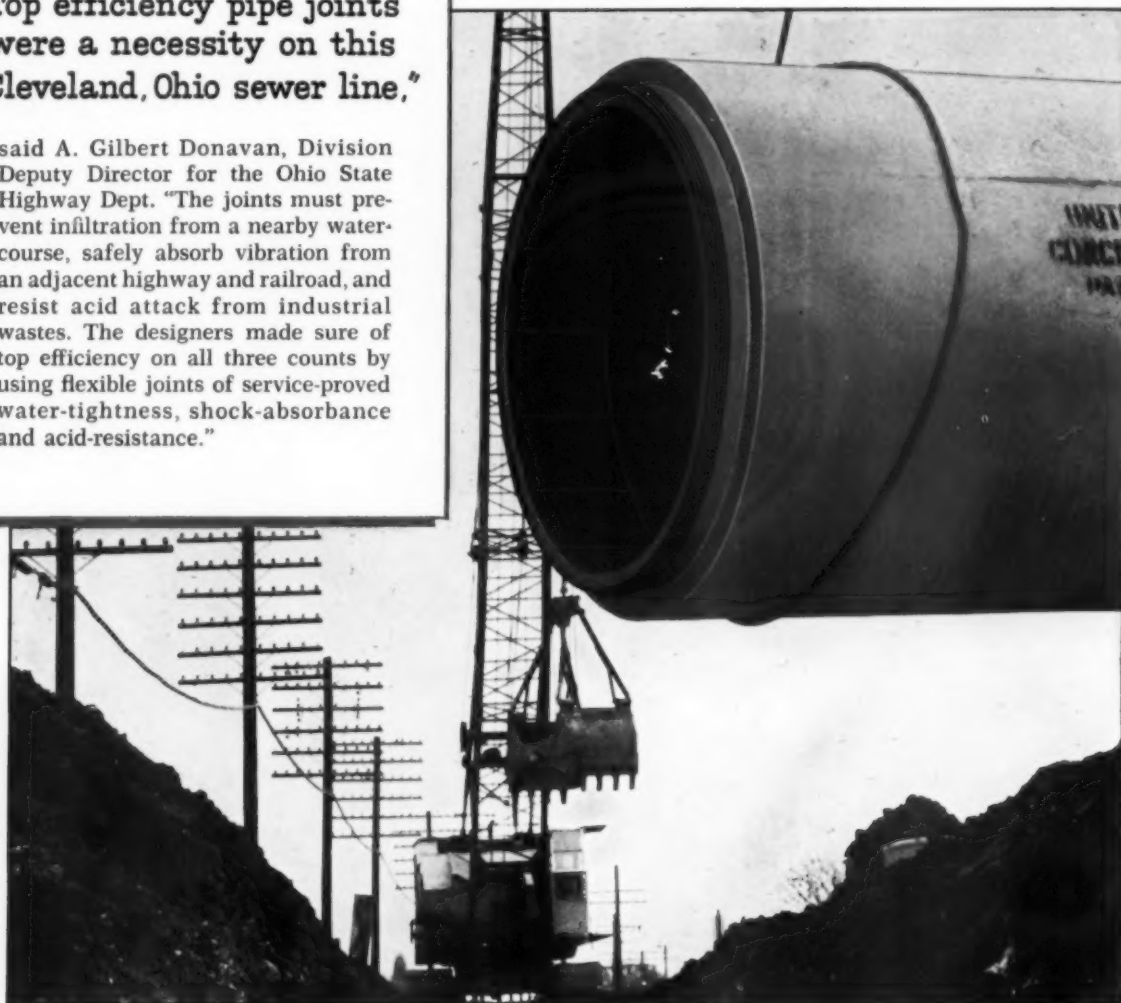
July, 1961



George W. Andress has been Executive Director of the Department of Public Works of Newark, New Jersey, since 1954. In addition to being responsible for the direction of the ten divisions of the Department of Public Works, he is a member of Newark's Central Planning Board. See page 18 for additional data.

**"Top efficiency pipe joints
were a necessity on this
Cleveland, Ohio sewer line,"**

said A. Gilbert Donavan, Division Deputy Director for the Ohio State Highway Dept. "The joints must prevent infiltration from a nearby watercourse, safely absorb vibration from an adjacent highway and railroad, and resist acid attack from industrial wastes. The designers made sure of top efficiency on all three counts by using flexible joints of service-proved water-tightness, shock-absorbance and acid-resistance."



TYLOX® Rubber GASKETS *were used . . .*

OWNER: Ohio State Highway Dept., Columbus, Ohio

CONSULTING ENGINEERS: Alden E. Stilson & Associates, Cleveland, Ohio

CONTRACTOR: Bates & Rogers Construction Corp., Chicago, Ill.

PIPE: 48" RCCP, fully lined with vitrified clay plates, manufactured by United States Concrete Pipe Co., Cleveland, Ohio

JOINTS: Tylox Type "C" Rubber Gaskets

Are you taking advantage of Tylox Gaskets to assure quick pipe coupling, and water-tight, acid-resistant, vibration-proof performance for the concrete pipe lines you design? If you are not thoroughly familiar with this most efficient of all compression gaskets, write for The Tylox Manual. It contains illustrated case histories of Tylox installations the world over, engineering information, data and diagrams on gasket types, and guides for writing rubber joint specifications.

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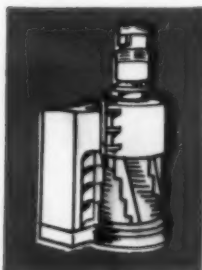
Write for Bulletin 184

from **Chicago**

A SMALL COMPACT 4 inch COMMINUTOR

Reverse cutting 4R Comminutor for packaged sewage treatment plants and pump stations.

The NEW 4R Comminutor screening and comminuting machine, smallest (25" high with 4" drum) of those manufactured by Chicago Pump is a self contained unit with stainless steel cutting teeth and comb. This new reverse cutting concept of comminution provides increased sewage solids cutting capacity. The cutting teeth, driven by a 1/4 hp motor automatically cuts all solids in the sewage inlet line. The unit with its adaptable mounting fits any inlet line and can be easily removed without pipe disturbance.



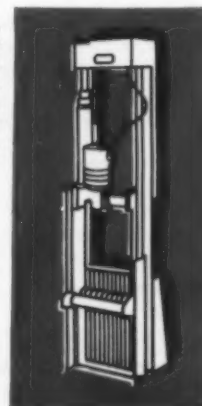
LARGER COMMINUTING MACHINES

THE ORIGINAL COMMINUTOR

The original Comminutor, developed by Chicago Pump provides continuous screening and cutting of coarse sewage matter for use in hydraulically designed feeder basins. Sized for flows of .175 to 25 MGD per machine.

MODEL "C" BARMINUTOR MACHINE

Model "C" Barminutor—reversible screening and comminuting machine for channels 1 to 3 feet wide. Outstanding features include single motor drive counterweighted for extended life, stainless steel screen, ball bearing shoes and reversible cutting for increased cutting action and cutter life.



Putting Ideas to Work
FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION

CHICAGO PUMP

622F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

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Best Bid purchase of No. 14 Motor Grader pays off in round-the-year value

When you put a 150 HP Cat No. 14 Motor Grader to work, you know you have a machine with the size and power to get a job done fast, allowing you to use it for other roadbuilding assignments.

Plattsburg, New York, needed such a productive machine in winter for removing snow from its 75 miles of township and village roads and, during the warm months, for repair, maintenance and building other roads. Township authorities decided that a machine the size of the No. 14 answered the year-round need for equipment with much higher productive ability than their older, smaller horsepower Cat Grader which had given nine years of superb service.

Purchased on the "Best Bid" basis, the No. 14 was \$5600 above the low bid. But the fact the trade-in value of the older Cat Grader was high and considering the quality manufacture, low operating costs, maintenance and depreciation of the No. 14, Plattsburg officials knew that the Caterpillar machine would cost them less in the long run.



Township Supervisor Bernard Amell believes in Best Bid buying of heavy equipment. As he says, "Public funds must have protection but price-tag protection breaks down and becomes self-defeating when applied to modern construction equipment. The exclusive consideration of initial cost of a complicated piece of machinery that must be used, serviced, main-

tained and repaired for several years results in miscarriage of legal safeguards. The accepted machine cost figure must include not only initial price, but also more important items such as fuel and oil consumption, ease in servicing, maintenance costs."

If you don't need a machine of the size and capacity of the No. 14, your Caterpillar Dealer can show three other motor graders: the 85 HP No. 112E, the 100 HP No. 112F, and the 115 HP No. 12E. Ask him for other cost records that prove Cat Graders give you lowest total cost.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

BUDGET STRETCHING FEATURES OF THE NO. 14

- Weight and stability: a hefty 28,520 lb.; 14.00-24 tubeless tires give superior traction.
- Easier service: exclusive Caterpillar Oil Clutch gives up to 2000 hours' service without adjustment. Dry-type air cleaner removes 99.8% of dirt from intake air.
- Versatility: with attachments like snow plow and snow wing, scarifier, ripper, or bulldozer blade (shown above).

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

**TO GET MORE
JOBS DONE FASTER—
THE NO. 14**

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

JULY, 1961 • Volume 92, Number 7

Unusual Storms Tax Drainage Facilities 89	Planning for Annual Highway Maintenance 111
<i>Inquiry into the adequacy of county drainage facilities followed an unusual number of complaints.</i> ALFRED R. PAGAN	<i>Carefully planned and controlled program regulates highway maintenance activities in New Jersey.</i> GEORGE J. MCCANN AND RALPH STELLJES
Tractor Seat Wired for Safety 92	Organization of a Traffic Engineering Department 113
<i>Use of a circuit-breaking cable stops engine if operator is unseated.</i> R. W. PECAUT	<i>Special training and interests of a traffic engineer have proven to be valuable assets on engineering work in Skokie, Ill.</i>
Pumping Water at Variable Speed—With Efficiency .. 93	Unique Survey Control System Improves Urban Mapping 115
<i>Excellent operating records being established by variable speed pumps in water systems promise greater use of this equipment in the future.</i> ADAM W. KUBIK	<i>Compilation of urban maps to assure accuracy, recoverability and utility to the local surveyor and municipal official has been a significant capital investment in Madison, Wisconsin.</i> KURT W. BAUER
Irrigation Disposal of Industrial Wastes 96	Force Account Construction and Direct Purchases by Water and Sewage Utilities 118
<i>A review of the results of spray methods and ridge and furrow irrigation for industrial waste disposal in Wisconsin.</i> T. F. WISNIEWSKI	<i>Direct purchases represent an impressive and uniform market potential.</i> WALTER L. PICTON
Aerial Study of Tunnel Approach Traffic Problems 97	Roadside Development on Ohio Interstate Routes 120
<i>How aerial strip photography records valuable data on traffic speeds and density.</i>	<i>Rest areas with "Travel Tip" stations are an important new service provided on Ohio highways.</i> W. J. GARMHAUSEN
Landscape Development Policies for the Interstate Highway System 99	Solving Sewage Sludge Pumping Problems 222
<i>Utilization of natural and designed features provides a roadway which is functionally effective, aesthetically pleasing and economically maintained.</i>	<i>A review of control systems designed to match withdrawal with production.</i> ART F. VONDRICK
Studies on Oxygen Demand of Sterile Sewage 103	Soils Laboratory Assures Quality Control of County Road Building Materials 125
<i>The well-known indicator organism, E. coli, influences BOD exertion in sewage, but possibly just in the carbonaceous cycle.</i> C. E. KEEFER	<i>The laboratory earns its way in providing material quality control, testing services and exploratory work.</i> BOB KAROLEVITZ
Automatic Valveless Filters Treat Water for Hyde Park 105	Compression Joints Aid Sewer Contractor 127
<i>Expansion of existing treatment plant proved to be the most economical answer to this community's water supply problems.</i>	Modification of Incinerator Precipitator Baffle Saves \$15,000 per Unit 174
Baltimore Beltway is Years Ahead of Old Schedule 107	PUBLIC WORKS DIGESTS:
<i>Accelerated construction schedules will complete this facility in 1962 instead of the 1970's.</i>	Highways and Airports 136
Incinerator and Sewage Treatment Plant Work Together 109	Water Works 148
<i>Operating experience at the Whitmarsh, Pa., refuse and sewage sludge incinerator.</i> B. B. REILLY	Sewerage and Refuse 160
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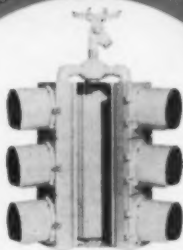
Established 1896
Public Works T. M. Reg. U.S. Pat. Off.

Published Monthly by Public Works Journal Corporation. Office of Publication at Orange, Conn. Editorial and Advertising offices at 200 So. Broad St., Ridgewood, New Jersey. Subscription rates: U.S.A. and possessions, \$5.00. All other countries, \$7.00. Accepted as controlled circulation publication at Orange, Conn.

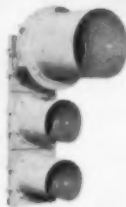


PUBLIC WORKS JOURNAL CORP.
200 So. Broad St., Ridgewood, N. J.

A Complete Line of Traffic Signals By **ECONOLITE**



Three way three section 8" Signal
for Span Wire Mounting
#3-E31G1G1A-4003A.



12" Signal Adapter, "Red Lens" shown
installed on 8" Signal. Adapter
Complete, #TA11GGA.



12" Signal Adapter, "Green Arrow"
shown installed on 8" Signal.
Adapter Complete, #TA14GGA.



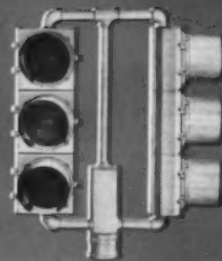
One way three section 12" signal
with Elevator Plumbizer and Back-
plate #1-T31G2G2A-8002.

ADVANTAGES

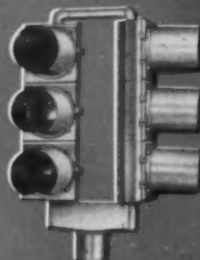
1. Complete assembly flexibility into rigid units.
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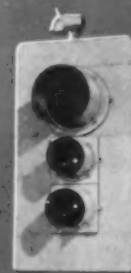
One way three section 8" Signal for
Span Wire Mounting #1-E31G1G1A-
4001A.



Two way three section
8" Signal for Post
Top Mounting with Ter-
minal Compartment
#2-31G3G1A-3002.



Two way three section
8" Signal for Horizontal
Post Top Mounting
with Terminal Compart-
ment #2-E31G3G1A-
8005.



One way three sec-
tion Combination Sig-
nal 12" Red 8" Amber
and Green with Back-
plate for Adjustable
Mast Arm Mounting
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ECONOLITE
CORPORATION



Write for further information...

Factory and General Offices
8900 Bellanca Ave.,
Los Angeles 45, Calif.



Common Sense in Public Works Equipment Replacement

LOOKING AT the reports of many cities and counties, one is impressed by the often apparent lack of good business judgment in equipment replacement. In one case repairs on a truck valued at \$150 totaled almost three times as much. Over and over again, most any cost control system will show that operating equipment to or below scrap value is a losing proposition. In most places and most cases a 5-year cycle of operation and replacement will procure fair trade-in values for a considerable part of city and county equipment and will result in better work, lower costs and improved morale on the part of operating and directing personnel.

Some Convincing Road Statistics

AT THE MEETING of the ASCE held in Phoenix, Arizona this past spring, Ellis L. Armstrong, President of BHIF, offered some thought-provoking statistics on ownership costs for our nation's highways, roads and streets. Using 1956 price levels as a base, he estimated that our 1975 road system would be handling 1,145,992 million vehicle-miles of travel each year while ownership cost, including cost of right-of-way, construction, administration and maintenance, would be \$10,940 million annually. This represents an annual cost of less than one cent per vehicle-mile of travel. Equally significant was the breakdown of these annual ownership costs, \$4,373 million or 40 percent of which were represented by maintenance and administrative expenditures.

These are convincing statistics for us all to remember in stating our case for: 1) Full and enthusiastic support for the continuation, as scheduled, of our Federal-Aid highway program; and 2) recognition of the major part that maintenance will have in protecting and assuring full effectiveness of our road system.

Halfway Area Problems and Solutions

IT USED TO be that our populated areas were pretty clearly indicated in respect to sewerage. You lived in a section served by sewers; or you didn't. In the latter case you had a home septic tank or you used the 1790 model outdoor toilet.

Solid kitchen wastes went to the cat, dog and/or pigs and chickens; liquid wastes irrigated the back yard.

This was possible because in the older suburban areas houses were generally widely spaced. Now the situation is different. Builders and developers lay out small lots and build houses close together. The trappings of progress have increased the volume of waste water. Within the boundaries of the average suburban lot there is rarely room enough for an individual sewage disposal system.

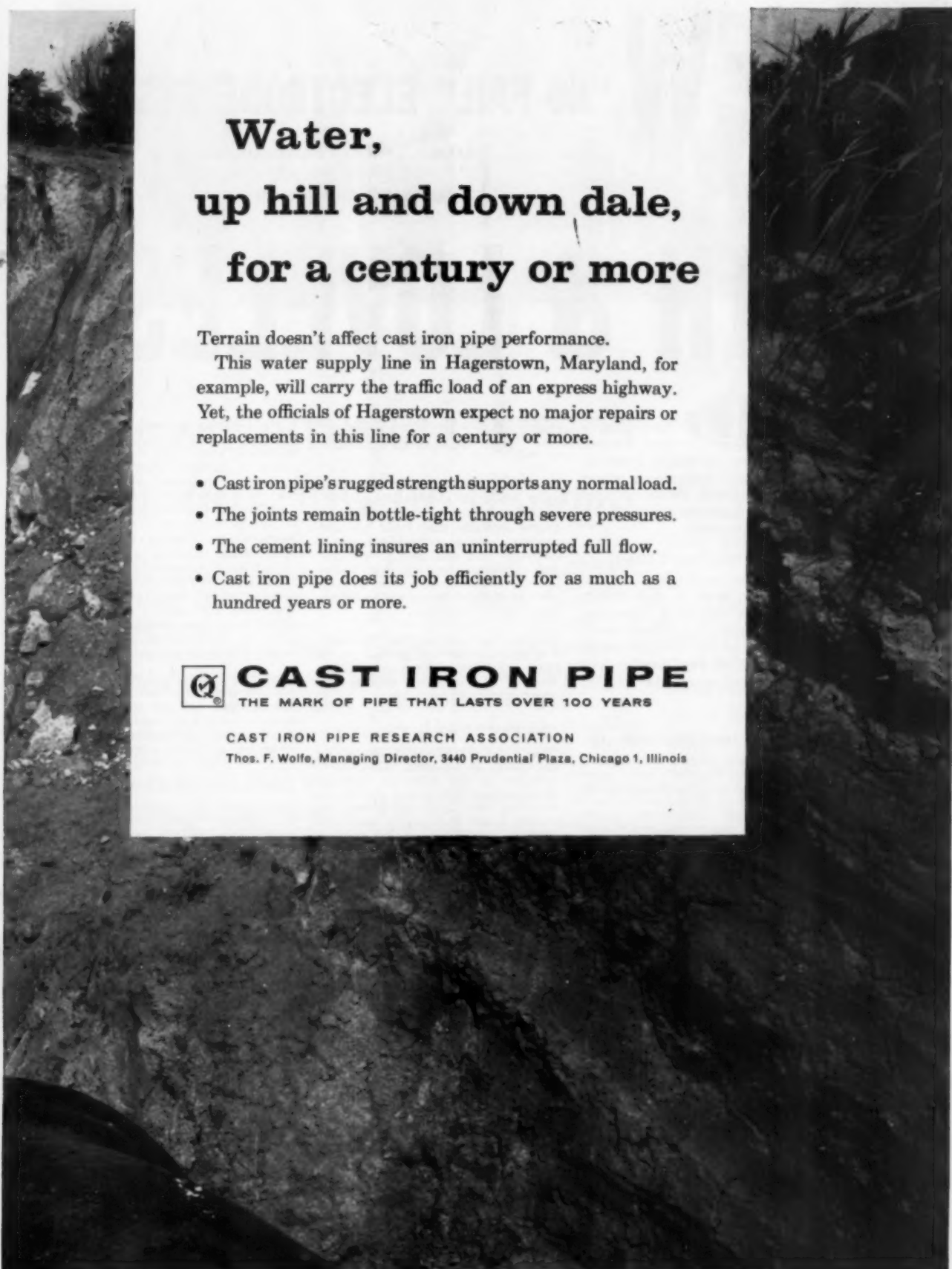
In solving this problem, the needed step, which may seem bold to some, is to install in all these built-up areas a sewer system and a treatment plant, either temporary or permanent, as the need may be. Engineers have developed package plants that will give a high degree of treatment and can, in many cases, be salvaged for use elsewhere. While appreciating that the widespread use of such equipment will create some problems, we urge their fullest possible utilization in eliminating soil and water (and often air) pollution. The problems will turn out to be largely minor. Delay is not an answer for the problems will not solve themselves. It is time to act as swiftly and as soundly as we can.

Potholes—Penalties of Civilization

CIVILIZATION brought pavements and pavements brought potholes. From the earliest Roman paved roadways with their broken chariot axles to modern America with its broken automobile springs, the pothole has been an annual plague. In different lands and different languages the profanity due to them has been the same in nature. Again, with the unusually severe winter of 1960-61, many a motorist has gone from icy skid to costly grief as the ultimate crash awaited him beneath the deceptive depths of the water-filled pothole.

In all seriousness, there is little that can be done except to get to work on them as soon as conditions will permit, and stay everlastingly with them until the last pesky one is neatly and permanently filled. Aside from their inherent dangers, they are ranked with those little annoyances that add to or subtract from the taxpayer's estimate of his city engineer's and street superintendent's capacities and concern for their citizens. Beyond the city limits this holds equally good.





Water, up hill and down dale, for a century or more

Terrain doesn't affect cast iron pipe performance.

This water supply line in Hagerstown, Maryland, for example, will carry the traffic load of an express highway. Yet, the officials of Hagerstown expect no major repairs or replacements in this line for a century or more.

- Cast iron pipe's rugged strength supports any normal load.
- The joints remain bottle-tight through severe pressures.
- The cement lining insures an uninterrupted full flow.
- Cast iron pipe does its job efficiently for as much as a hundred years or more.



CAST IRON PIPE

THE MARK OF PIPE THAT LASTS OVER 100 YEARS

CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

NEW FROM SMITH & LOVELESS

* "NO-FAIL" ELECTRODE SYSTEM

AN EXCLUSIVE, DEPENDABLE NEW SYSTEM
DESIGNED TO ELIMINATE COMMON
CAUSES OF FAILURE IN SEWAGE EJECTORS



An exclusive new system to eliminate the major types of failure which sometimes occur in conventional electrode systems has been announced by Smith & Loveless.

The new "No-Fail" Electrode System has been added, at no increase in cost, to the highly dependable Smith & Loveless "Mon-O-Ject" and "Du-O-Ject" pneumatic ejector lift stations to make them the most trouble-free sewage ejectors on the market today.

System Assures Dependability

The "No-Fail" System is composed of heavy-duty rectifiers and capacitors that change alternating current to direct current, ultra-sensitive direct current relays, high-accuracy timing units and a newly designed hollow electrode. All components have been selected to provide utmost dependability and are connected in a fashion which truly provides an electrode system that, with proper maintenance, cannot fail to operate even though grounded or insulated to a degree that would cause a conventional-type ejector to fail.

Types Of Failure Explained

There are two basic types of failure that can occur with any conventional electrode system: First, the electrode tip may become coated with grease, mineral deposits and other foreign material which act as insulation and prevent the electrode from making an electrical circuit with the liquid. As a part of the new "No-Fail" Electrode System, Smith & Loveless has added a large, hollow, non-rusting electrode with greatly increased surface area to the ultra-sensitive DC

relay which practically eliminates the insulation hazard to the electrode system.

Secondly, failure will most commonly occur when an electrode becomes grounded by wet stringy material or grease deposits that build up and conduct electrical current between the electrode and the sewage receiver wall. Normal maintenance cannot prevent this type of failure. It happens suddenly and in a completely unpredictable manner.

Only the Smith & Loveless "No-Fail" Electrode System will prevent failure from grounding which puts an ejector out of operation, causing the sewer system to back up.

"No-Fail" System Described

The "No-Fail" Electrode System in the Smith & Loveless "Du-O-Ject" operates in the following manner: When sewage fills one of the sewage receivers, the liquid completes the circuit from the single electrode, through the liquid, to the receiver wall which is at electrical ground potential. This energizes the DC relay which operates a three-way air valve and starts an adjustable timer. The electrical timer keeps the three-way air valve energized for a predetermined period of time while the sewage is ejected from the sewage receiver. When the timed cycle is completed, it releases the interlocks that prevent both of the receivers from ejecting at the same time, permitting the other receiver to eject when it has filled. At the end of the cycle in the other receiver, its timer will release the interlocks on the first receiver.

With the new "No-Fail" Electrode System, the timer will break the

relay circuit at the end of the ejection cycle, even if the electrode is grounded, permitting the other receiver to operate when the liquid level comes in contact with the electrode in that receiver. If the electrode in either receiver becomes grounded, it will perform an ejection cycle immediately following the ejection cycle of the operative unit, whether or not the receiver is full of sewage. If the electrodes in both receivers become grounded, the "Du-O-Ject" station will operate in alternating cycles, providing continuous service, until the maintenance operator can return the ejector to normal service.

Frequently the rush of air during the ejection cycle will flush any grounding material off the electrode and remove the failure condition. When this happens, the system will return to normal operation automatically.

Lights Indicate Grounding

When grounding occurs, new "No-Fail" indicator lights on the electrical control panel tell the operator during his daily visit to the station that the unit is operating under "failure" conditions, that he should check for grounded electrodes.

With the "No-Fail" Electrode System, Smith & Loveless has again pioneered an important improvement in the sewage and industrial wastes field . . . by eliminating the major causes of ejector failure.

Available only from Smith & Loveless . . . write today for specifications.

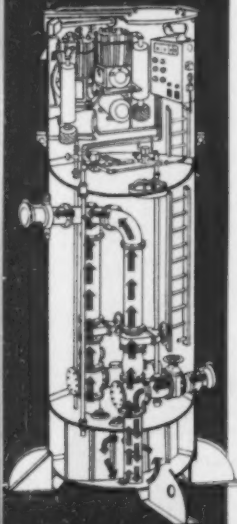
Address: Department 40.

* Patent Pending

Smith & Loveless

P. O. BOX 8884 / KANSAS CITY 15, MISSOURI / PLANT: LENEXA, KANSAS

(2827)





Seal Coating with Cationic Bitumuls produced uniformly fine results in spite of early showers

CATIONIC BITUMULS SPEEDS SEAL COATING IN TACOMA

The City of Tacoma, Washington, has two major sources of street maintenance problems. First, some forty miles of very old (1890-1915) sheet asphalt surfaces. These are now badly cracked and extensively patched. Second, several hundred miles of streets that have only a light bituminous treatment. The ever-increasing traffic load is starting to cause trouble on these.

In the past, the City has settled for continuous patching on the sheet asphalt; and Seal Coating of the light bituminous arterials, using either anionic emulsions or cutbacks. The Seal Coating required closing the streets to traffic for long periods; and weather was a constant threat, restricting the work seasonally.

City maintenance forces were quick to see two major advantages of Cationic Bitumuls when it was first introduced. A—This material

had a natural affinity for the cover aggregate being used. B—The rapid-setting characteristics sharply reduced the danger of "wash-off" from rain. (When showers actually occurred within two hours of job completion, there was no damage!)

Based on earlier work the City was able to "field" a well-integrated Seal Coating team. Cationic Bitumuls sets rapidly so that Seal Coating operations were co-ordinated even more closely. Both the cover-stone truck and the pneumatic roller could follow very closely behind the distributor!

The Seal Coating operation has now been extended to the "ancient" sheet asphalt pave-

ments. Here it prevents the break-up action that made earlier patching necessary.

Using Cationic Bitumuls, streets are closed to traffic a much shorter time; and the work season begins much earlier in the year.

Discover for yourself the ability of Cationic Bitumuls to extend the work season; and to coat and hold most aggregates—even those normally regarded as "difficult". Bitumuls Engineers in our nearest office will supply full information; and will arrange for you to see a Cationic Bitumuls job in your area.



Close-up view of a Cationic Bitumuls Seal Coat. Note uniform cover-stone retention



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B Miller Towed Paver with Heated Screenshot

A Miller Curbuilder

C 1 to 2-Ton Vibratory, 2 to 3-Ton Roller

3 to 5-Ton Vibratory Roller

D Miller Tailgate Curb Loader

E Miller Self-propelled Asphalt Paving Machine

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DO THE WHOLE JOB

with MILLER'S FULL LINE of Asphalt Paving Equipment

Whether you're paving a driveway or a highway, there's a Miller machine to do the whole job... from compacting and rolling of bed to extruding a curb. Small contractors, large contractors and middle-size contractors can find the best answer to every aspect of asphalt road building or re-paving with Miller's new line.

Those who have long recognized Miller as the builder of uniquely superior spreaders and Curbuilders are welcoming Miller's new self-propelled paver, vibratory rollers and tailgate curb loader.

To put down the best road... **AT PEAK PROFIT FOR YOU...**
put Miller on your job.



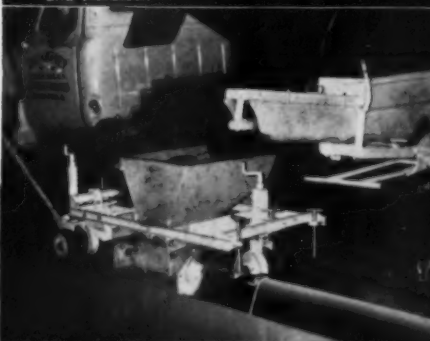
A Curbuilders extrude asphalt or concrete in any form on any grade.



B Towed paving machines pave with either hot or cold bituminous concrete.



C Miller vibrating rollers are best-designed and sturdiest.



D Curb loader is the sensational new partner to Miller Curbuilders.



E New self-propelled hydraulic paver features simplicity of design.

MILLER SPREADER CORPORATION

4020 Simon Road — Youngstown 12, Ohio

RESEARCH CUTS SEWER LINE COSTS!



The Clay Pipe Industry's research has pioneered dramatic new developments, making production and installation of lifetime Vitri-fied Clay Pipe more efficient and effective.

For example, Clay Pipe Industry research discovered the revolutionary resilient compression joints which are now offering important savings in installation time and cost to users of lifetime Vitri-fied Clay Pipe sanitary sewers.

Other important tests are now going on at the Crystal Lake facility, by contract at

colleges and universities all over the country, and at the modern laboratories maintained by individual Clay Pipe manufacturers.

One experiment that promises to have far-reaching effects: detailed, year-long observations of root penetration of 16 separate sewer pipe joints. Others include shear load studies of both pipe material and joints, development of new, less expensive jointing materials and techniques, exhaustive analyses of competitive products, flow-coefficient studies, and various tests aimed at improving the clay pipe itself.

Results of the most significant of these tests will be announced as they become available.

Under the direction of A. J. Reed, NCPMI Vice President and Director of Research, new breakthroughs in manufacturing and uses of Clay Pipe are being made, offering greater, more confident service to those who specify and use lifetime Vitri-fied Clay Pipe.



NATIONAL CLAY PIPE MANUFACTURERS, INC., Washington, D.C.

COMPRESSION SEALED, VITRIFIED

CLAY PIPE

THE STANDARD in SANITARY SEWERS

IMPERVIOUS

NATIONAL CLAY PIPE MANUFACTURERS, INC.
914 20th Street, N. W.
Washington, D. C.

Please send me full details on the new factory-made compression joints on Clay Pipe.

(name)

(company)

(street address)

(city and state)

B-1C1 PW



known
by the
companies
it keeps
moving



Thousands of leading American companies keep their investment at a minimum with a 'Jeep' fleet. Great versatility and low initial cost give you the most versatile vehicle you can possibly get for your money! Traditionally rugged 'Jeep' construction keeps maintenance costs low and the resale value high. Get in touch with us today for complete information! Write to: **Robert J. Kreusser, Fleet Sales Manager, Willys Motors, Inc., Toledo 1, Ohio.**

Jeep
VEHICLES



'JEEP' FLEETS—FROM THE WORLD'S LARGEST LINE OF 4-WHEEL DRIVE VEHICLES

Willys Motors, Inc., Toledo 1, Ohio. One of the growing Kaiser Industries.



With a $\frac{3}{4}$ -yd. dragline bucket, BANTAM T-350 cleans out ditches alongside streets in Minden, La. High-speed production (up to 115 yds. per hr.) makes quick work of the job, lets Minden move its BANTAM on to other chores with savings in time and money.

City superintendent says:

"BANTAM is the best machine available for city work"

"We do anything we have to do with our BANTAM," reports Superintendent R. K. Whitlock of the Minden, Louisiana, Street and Water Dept.

Minden uses its BANTAM on all kinds of jobs—cleaning out drainage ditches after heavy rains, loading gravel and sand for street maintenance, etc. "BANTAM is mobile and fast—and much more productive," says Mr. Whitlock. "I'd recommend BANTAM to any city that wants efficient, low-cost equipment. It's the best machine available for city work."

BANTAM IS A REAL "BUDGET-SAVER"

BANTAM T-350 is the most practical tool for handling jobs all over town: sewer and water line extensions and repairs, drainage ditches, culvert work, street and alley repairs, sanitary landfill projects. It's tops for all excavating work, materials-handling or speeding

municipal building projects. As Superintendent Whitlock puts it, "BANTAM is as handy as a pocket on a shirt!"

Practical-sized BANTAM travels and works easily even in congested areas. BANTAM's big-rig features, 11-ton capacity and exclusive engineering advantages assure high speed, dependability and low operating cost.

11-ATTACHMENT VERSATILITY

With its 11 quick-change attachments, BANTAM is ready to work anywhere. And more than 25 optional features enable you to buy your BANTAM exactly as you want, to fit your specific job needs.

Let us prove to you why BANTAM is the most useful, all-around rig you can own—the best investment for cities, towns and counties.

BANTAM COMPACT 250—New all-purpose, low-price crane-excavator! If you have a low budget yet want a big performing rig, the new Bantam Compact 250 is your perfect answer. It gives you Bantam's famed wide work range to do hundreds of jobs—trenching, loading, handling, cleanout, erecting, etc. You travel easier with Bantam's high-mobility. Lifts five tons, digs down to 12'11" with backhoe, (cable or hydraulic bucket control available). Ultra simplicity; cable-controlled digging-lifting operations—smooth, hydraulic 370° swing. Available on Bantam-built 4 x 4 carrier or mount on your own truck. Ask for details.

PW-284



301 Park Street, Waverly, Iowa

World's largest producer of truck crane-excavators



in Badger's *Easy-Read*^{*} sealed register

Look into the workings of this Badger Easy-Read magnetic drive meter. Its instrument gearing is smaller, lighter in weight, lower in friction than ever before possible.

Neither water leakage nor corrosion makes demands on the mechanism. Magnets rotate

on ball bearings, so the gearing turns freely with practically no resistance. With friction reduced, Badger Easy-Read can maintain accuracy far longer. Ask your Badger representative to give you a demonstration of the new Badger Easy-Read magnetic drive meter.

*Trademark

The new Easy-Read can be ordered in split-case ($\frac{5}{8}$ " thru 2") or frostproof models ($\frac{3}{8}$ " thru 1" x 1 $\frac{1}{4}$ ").

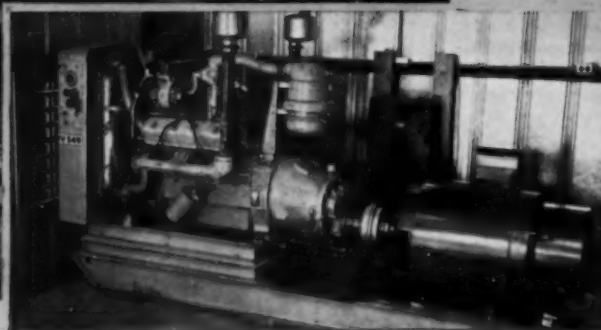


Badger Meter Mfg. Company

4545 West Brown Deer Road • Milwaukee 23, Wisconsin

Safe, instant picture power from transmitter 2 MILES HIGH!

Right, Station Engineer Thomas Dice at transmitter control panel. Left, dependable International standby engine supplies emergency power for TV transmission, FM transmission, antenna de-icer and building utilities.



International standby engine prevents interruption in wide-area telecasting

Television station KKTV in Colorado Springs telecasts from a transmission tower on a mountain peak 10,000 feet above sea level. This greatly extends receiving range but creates a power problem. Remote mountain peaks are often exposed to high winds, rain, sleet and snow. Power lines from studio to transmitter may become damaged, resulting in loss of picture.

To insure perfect power through any emergency, KKTV engineers installed a generator set powered by an International UV-549 standby engine at the transmitter. If a line breaks, the dependable V-8 restores full operating power of 72 kw in just seven seconds. Engine speed must be controlled to achieve a frequency variation of less than one-half cycle. The governor is so accurate, generator frequency is virtually constant.

Chief Engineer Chet Wallack says: "With this International engine on emergency standby power, we have eliminated loss of picture. Thanks to this equip-

ment, we are able to take advantage of mountain-top transmission, to deliver a clear picture over greater distances, while maintaining continuous performance on a par with easily accessible transmitter locations."

When you need dependable power for generators, pumps, construction machinery, police and emergency equipment, or auxiliary units, call your nearby International Engine Distributor or Dealer. He'll give you full information on International's 35 diesel or carbureted engines, 16.9 to 385 max. hp.

INTERNATIONAL[®] **HH ENGINES**

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Ill.
A COMPLETE POWER PACKAGE

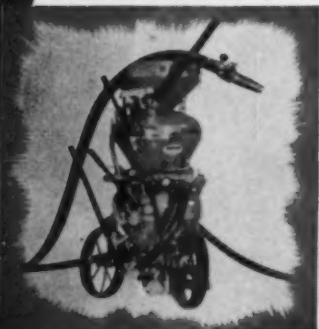
CONCRETE COSTS GO DOWN WHEN YOU MOVE UP WITH

AIRPLACO

"ADVANCED DESIGN" CONCRETE GUNNING EQUIPMENT

Field Engineered and Field Proved . . .
Best For All Concrete Restoration and Construction.

WHEN THE JOB CALLS FOR CONCRETE . . . CALL FOR AIRPLACO



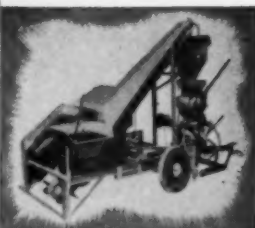
AIRPLACO CONCRETE GUNS for Restoration and Repair of Roads, Streets, Bridges, Culverts, etc. Choose from six different models in a complete line of concrete guns. Whatever your production requirements—from ½ to 8 cu. yds. per hour—there is an AIRPLACO BONDACITOR or NUCRETOR to meet your needs.

AIRPLACO MIX-ELVATORS

for Faster, Easier Proportioning, Mixing, Elevating and Screening. Choose from three models. Capacity up to 12 yds. per hour.

AIRPLACO GROUTER AND PLACER for Easy-to-Use, Versatile Grouting and Placing of Concrete and Other Materials.

The portable Model G-6 Grouter and CP-10 Placer is ideal for soil stabilization, tunnel backfilling, filling hard to get to forms, etc. Both the G-6 and CP-10 have capacities of up to 5 cu. yds. or more depending on materials used and job conditions.



AIRPLACO JET-BLASTERS For Low-Cost, Easy-to-Use Sandblasting (wet or dry). The Model B-6 single charge (650-lb. capacity) and B-3C continuous feed (500-lb. capacity) Jet-Blasters are designed to handle all abrasive materials for cleaning, polishing, or etching of any type of surface. Jet-Blasters are available with accessories for wet or dry blasting and new exclusive "Sand-Saver" remote cut-off valve.

Let Us Help You Solve Your Concrete Problems
Our experience in solving unique problems involving the handling of concrete has saved thousands of dollars for others. This experience is available to you. Write, wire or phone us, anytime.



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AIR PLACEMENT EQUIPMENT CO.

1013 WEST 25TH ST. • KANSAS CITY 8, MO.

WORLD'S LEADING MANUFACTURER OF "ADVANCED DESIGN" PNEUMATIC PLACING EQUIPMENT

The Man on the Cover

George W. Andress is Executive Director of the Department of Public Works of Newark, N. J. He has been with the city in the engineering and public works field since 1916. As Executive Director of the Department, he is responsible for directing and coordinating the work of its ten divisions. In addition, he has been a member of the Newark Central Planning Board since 1954.

His experience has included overall charge of the development of the \$10 million Charlotteburg Reservoir addition to Newark's water supply; the construction of the new \$13 million Martland Medical Center Hospital; the \$7 million interceptor sewer for Newark's South side, now under way; a \$1.5 million flood elimination project; and many smaller items. His broad knowledge of Newark's needs stem from his long-time association with the city. Starting as street maintenance engineer he advanced through all the engineering grades to Chief Engineer, Department of Public Works. The appointive title of Director dates from 1954.

He was graduated from Cooper Union with the degree of BE in 1913; and received the CE degree in 1920.

He is a member of various technical societies and associations, including ARBA, ASTM, NSPE and APWA of which he is a past director. He and Mrs. Andress have one son. His hobby is his work; but he hopes when retired to catch up on his fishing and travel.

Detergents in Water Supplies

A questionnaire submitted to water works officials recently asked about the presence of synthetic detergents in tap water. From 465 specific replies, there were reports of 34 such occurrences in surface water and 6 in ground water. Interference with water treatment due to the presence of detergents was reported by 10 cities; and 6 cities reported some complaints from consumers but mostly of a relatively small extent.

PUBLIC WORKS for July, 1961

*quickly installed
in old piping!*

MUELLER copper meter yokes

NEW compression couplings

*...for steel or copper pipe
...with or without
locking nut*



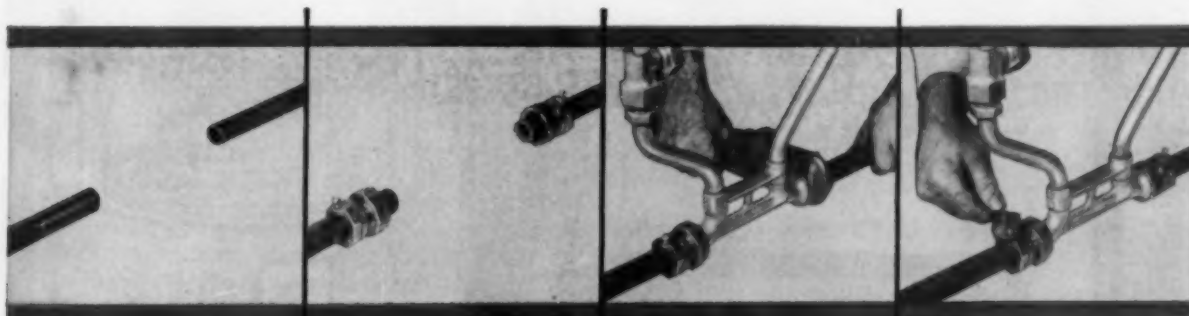
You can now install Mueller Copper Meter Yokes in any existing steel or copper piping in just a few minutes — and without cutting threads or sweating joints.

The simple step-by-step procedure for installing a yoke with Mueller's new Compression Couplings is shown below. Permanent, water-tight joints are quickly made even on rough and badly pitted pipe. Possible trouble is avoided because the piping does not have to be moved.

These new, time-saving couplings are now available for all Mueller Copper Meter Yokes with Multi-Purpose Ends. Regular compression nut or locking nut designs can be furnished for steel or copper pipe.

The locking nut type (shown) positively prevents any movement of the yoke on the pipe and insures continuous electrical bonding of the service piping.

Write for complete information and specifications on Mueller's Copper Meter Yokes.



1 Clean dirt, rust and scale from pipe and cut out a section just slightly longer than yoke (without coupling).

2 Remove all burrs from inside and outside of pipe and slip complete coupling over cleaned ends of pipe.

3 Align yoke between ends of pipe, slide couplings into place and tighten couplings securely onto yoke body.

4 Tighten compression nuts on pipe and lock yoke in place by tightening locking set screw on clamp. Setting complete.

Copper Meter Yokes are just a portion of Mueller's complete line of quality-matched meter setting equipment.

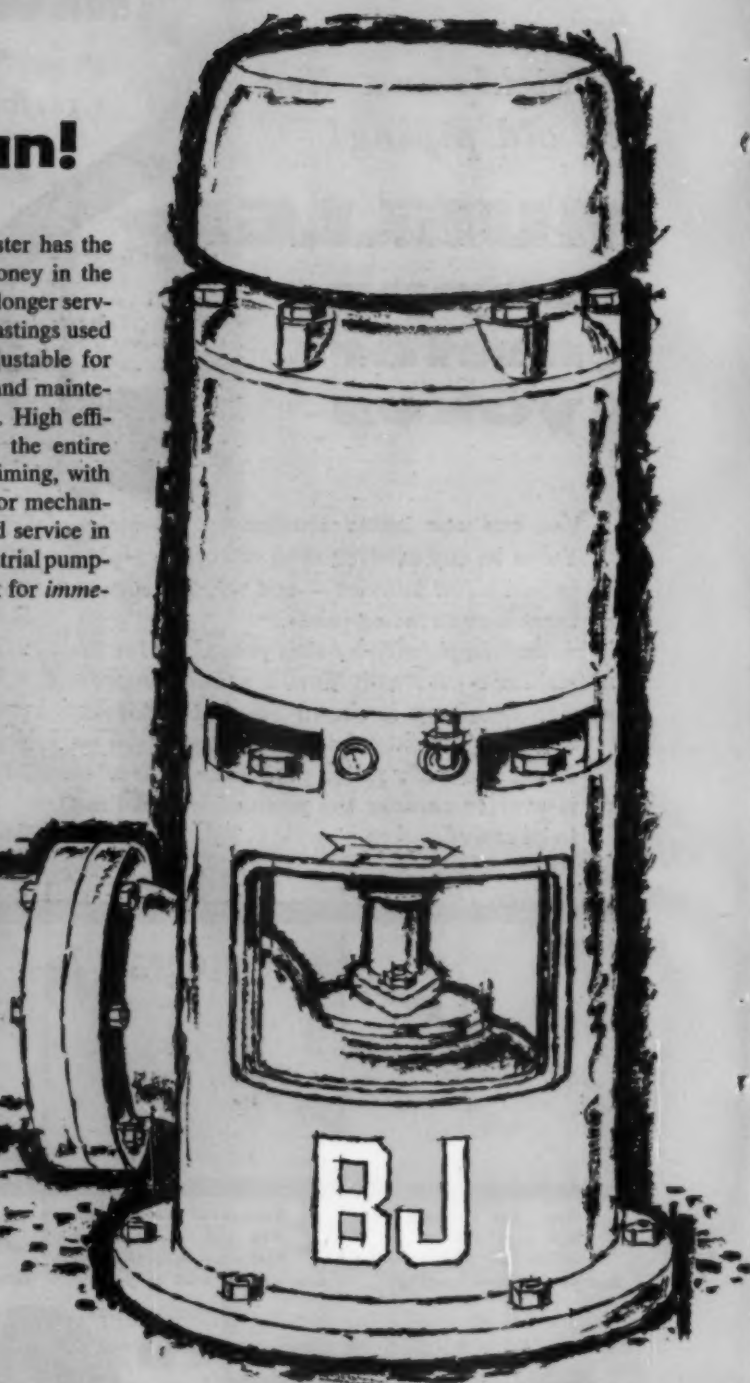


**MUELLER CO.
DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario.

These "extras" make
Sumpmaster
cost less in
the long run!

A heavy-duty, pre-engineered pump, BJ Sumpmaster has the "extras" in design and materials that save you money in the long run. High heads to 400 feet at low speed mean longer service, less wear and down time. Superior Meehanite castings used throughout—semi-open impellers are quickly adjustable for wear. Two-piece headshaft for ease of inspection and maintenance. Entirely self-contained for fast installation. High efficiency—non-overloading HP characteristics over the entire capacity range to 3500 gpm. Compact and self-priming, with choice of oil or self-lubricated shafting... packing or mechanical shaft seals. Sumpmaster is designed for rugged service in sump, circulating, cooling, booster and general industrial pumping applications—and it's now available from stock for immediate delivery.



BYRON JACKSON PUMPS, INC.

SUBSIDIARY OF BORG-WARNER CORPORATION

P.O. Box 70, Lawrenceburg, Indiana

P.O. Box 2017-A, Terminal Annex, Los Angeles 54, California





NOW! An ice control program that cuts accidents and complaints!

The Morton Safe-T-Salt* Ice Control Program can help you accomplish two important jobs this winter . . . public safety and public relations!

Streets are safer when they are salted with Safe-T-Salt, because it is a screened and graded rock salt that gets rid of dangerous ice and snow in the quickest, safest, most economical way possible.

The name "Safe-T-Salt" was developed to explain this job to the public. As you know, too many uninformed citizens complain about de-icing programs every winter. The "Safe-T-Salt" name will cut down those complaints by emphasizing the safety value of salting treacherous pavements . . . will keep the public aware of your efforts to reduce winter driving hazards.

The truck banner in the illustration above represents one way that safety salting can be made popular. These banners are available free to Morton Salt customers. Your Morton representative can supply them and other material . . . as well as furnishing you with helpful publicity features for your local newspapers, explaining the value of de-icing programs. He'll be glad to help you start planning *now* for a safer and happier winter.

FOR MORE INFORMATION ON MORTON
SAFE-T-SALT, MAIL THIS COUPON TODAY

Please have a Morton Salt representative call me for an appointment to explain all the advantages of your Safe-T-Salt program.

Name

Title

Address

City Zone State

**MORTON SALT
COMPANY**

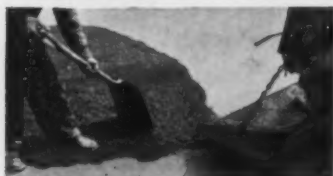
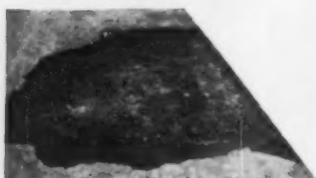
INDUSTRIAL DIVISION

Dept. PW7, 110 N. Wacker Drive, Chicago 6, Ill.

*Safe-T-Salt is a trademark of the Morton Salt Company



**FOR YEAR 'ROUND
LOW-COST PAVING
AND PATCHING, USE
A McConnaughay
MIXER**



**THE MOST COMPLETE
LINE OF ASPHALT
PATCHING MIXERS...**

Write today for your copy of "McConnaughay Presents the Most Complete Line of Asphalt Patching Mixers". This folder describes the complete line of mixers for patching or repairing on a wide variety of paved surfaces and for resurfacing or sealing streets, highways, joints and cracks, driveways, parking areas, sidewalks, and floors. From patching by the foot to paving by the mile a McConnaughay HTD Mixer will do the job.

HTD MIXER No. 10

½ ton per batch

HTD MIXER No. 8

½ ton per batch

HTD MIXER No. 5

¼ ton per batch

HTD MIXER No. 4-T

½ ton per batch

**McCONNAUGHAY
MIXERS, INC.**

LAFAYETTE, INDIANA

National distributors: Asphalt Equipment Co.
3314 Cherry Lane, Fort Wayne, Indiana

Export Representative: William H. Schuelie,
440 E. 79th St., New York 21, N. Y.



**PEAK RUNOFF FROM
SMALL WATERSHEDS**

This is a report of a research study by the Bureau of Public Roads on peak rates of runoff from watersheds of 25 square miles or less located east of the 105th meridian. The first two parts give statistical analyses of data from gaged and ungaged watersheds and correlates topography, precipitation and area. The third and fourth parts present a procedure for applying the research results and describes a step by step process, involving the use of lithographical and rainfall index maps and a series of correlation nomographs. 36 pages; reported by William D. Potter; 30 cents per copy from Superintendent of Documents, Government Printing Office, Washington 25, D. C.

**HIGHWAY GEOLOGY
SYMPOSIUM**

Proceedings of the first ten meetings of the Symposium on geology as applied to highway engineering are available as a 3-volume hard cover set at \$15. Checks should be made payable to the Treasurer, State of Virginia, and sent with the order to W. T. Parrott, Virginia Dept. of Highways, Richmond, Va. Copies of the 11th symposium are obtainable at \$2 from Dr. W. F. Tanner, Dept. of Geology, Florida State University, Tallahassee, Fla. For the 12th symposium (probably also \$2), write R. A. Lawrence, USGS, Post Office Bldg., Knoxville, Tenn.

**STRUCTURAL ENGINEERING FOR
ENGINEERS' EXAMINATIONS**

This book is designed to enable the reader to prepare for and pass the structural and civil engineering sections of the professional engineering examination given by the various state boards. It reviews basic theory and applies that theory to the solution of many problems, most of which have been culled from recent license examinations. It covers statics, stress and strain, cylinders under pressure, stresses in beams, design of steel beams and plate girders, and deflection of

beams, torsional stresses, roof and bridge trusses, timber design and soil mechanics. There is also material on reinforced concrete columns and beams, hydraulics, surveying and route design, and water supply and sewerage. Many worked out problems are given. By Max Kurtz; 341 pages; 247 illustrations; \$9; McGraw-Hill Book Co., New York 36, N. Y.

**PHYSIOLOGICAL ASPECTS
OF WATER QUALITY**

A conference of scientists was organized to investigate the present state of knowledge with respect to the physiological and toxicological aspects of certain chemical constituents in water. The proceedings of this conference make available for the first time a variety of detailed reports on the subjects of water quality; minerals and trace elements such as molybdenum, selenium, vanadium and zinc were discussed. The effects of insecticides, pesticides and other organic substances were reviewed.

Chemists and engineers have given some attention to the non-biological constituents of water but medical specialists, physiologists, toxicologists, biochemists, and biologists were also called upon for contributions. A wide variety of future research studies will be needed to explore the significance of many chemical constituents.

Copies of the proceedings (244 pages) are available upon request from: Chief, Research and Training Grants Branch, Division of Water Supply and Pollution Control, Public Health Service, Washington 25, D. C.

**STANDARD SPECIFICATIONS FOR
ROADS AND BRIDGES**

The Bureau of Public Roads has published a new edition of Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects. The book is intended primarily for use in the construction of Federal road and bridge projects under the direct supervision of the Bureau.

These FP-61 specifications are not required or intended to be used in Federal-aid highway work performed by the States with funds administered by the Bureau of Public Roads since. As prescribed in the basic Federal-aid highway legislation, each State prepares its own specifications for Federal-aid highway construction, subject to approval by Public Roads. However, these specifications will be of interest to specification writers in par-

REO



CUSTOM ENGINEERED FOR REFUSE REMOVAL

REO "C-SERIES" TRUCKS! Famous for economy under tough, stop-and-go operating conditions. Extremely short turning radius make them a cinch to maneuver in heavy city traffic and narrow side streets. Optional right hand drive available. **FOUR MODELS:** 18,500 to 31,000 GVW; 125- to 185-in. wheelbases; take 13 to 20 yd. refuse bodies. Powered by Reo's modern **GOLD COMET** engines (110, 130, 170, 185 h.p.) for more profitable payloads, minimum maintenance. *Gold Comet's* "wet sleeve" construction eliminates the need to re-bore cylinders or replace the block for the life of the truck. Available with fully proved, fully automatic **REOMATIC** transmission that eliminates gear shift guesswork, prevents engine lugging, minimizes chance of shock load damage.



Gold Standard of Values

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ticular and to most engineers in highway design and construction, as well as to engineering students. The 371-page publication is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at \$2.25 per copy.

TRAFFIC CHARACTERISTICS AT REGIONAL SHOPPING CENTERS

This study of traffic movements and parking habits at 14 major regional shopping centers in the East, Midwest and West, contains interesting and useful tabulations and

charts developed by staff members and graduate students at the Yale Bureau of Highway Traffic over a period of six years. The 77-page booklet is available (single copies without charge) from the Bureau of Highway Traffic, 311 Strathcona Hall, New Haven, Connecticut.

STATICALLY INDETERMINATE STRUCTURAL ANALYSIS

This book gives thorough treatment for three methods of indeterminate analysis commonly used by structural engineers: Moment area, virtual work and moment distribution. Other methods are also

presented and are explained adequately to acquaint the student with the values of each. There are numerous drawings and some fine problems and solutions. By R. L. Sanks of Gonzaga University; 602 pages; \$10; Ronald Press Co., 15 E. 26th St., New York 10, N. Y.

LITTLE ROCK WATER REPORT

The 1960 annual report of the Little Rock, Ark., Water Department is an excellent one and worth reading. L. A. Jackson is manager-engineer of the Municipal Water Works.

FEDERAL AGENCIES FINANCING RESEARCH

This is a third edition of a report which lists governmental agencies and the scientific fields they cover; and gives information on getting research contracts from governmental agencies. 26 pages; \$1 from Social Legislation Information Service, Inc., Washington 6, D. C.

JOHANNESBURG TRAFFIC PLAN

Even in South Africa there are traffic problems. This is not unexpected, considering that Johannesburg has a population of a million. The layout of the city, as is the case with many US cities, is an interesting factor. This 32-page report on the proposed solution has many excellent maps and pictures and may be helpful to engineers in other cities faced with a major traffic problem. The plan described involves the ultimate expenditure of roughly \$75 million. The report was sent us by W. Pryce Rosser, Chief Engineer of Major Roads, Box 4323, Johannesburg, South Africa.

ASTM STANDARDS ON CEMENT

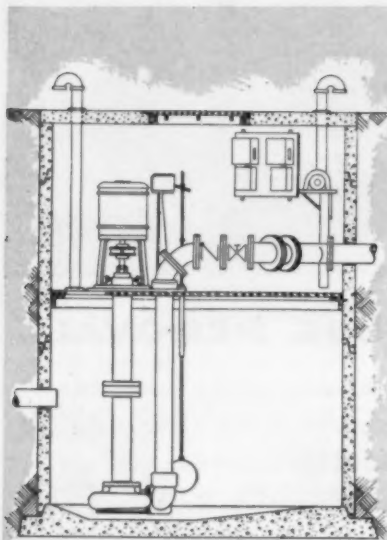
The 1960 edition of the Compilation of ASTM Standards on Cement, this volume contains 8 specifications, 26 methods of test and several definitions. Two specifications for laboratory apparatus are also included.

Methods added to since the previous edition cover false set of portland cement (paste method); fineness of hydraulic cement by the No. 325 sieve; and potential sulfate resistance of portland cement. Revisions have been made in 4 specifications and 8 methods are retained from the previous edition; and there are revisions also in the definitions. Changes and additions have been made in the Manual of Cement Testing and Selected References on Portland Cement. 288 pages; \$4; ASTM, 1961 Race St., Philadelphia 3, Pa.

AUTOMATIC

UNDERGROUND LIFT STATION

with the weil HEAVY DUTY Vertical Screenless Sewage Pumps



When sewage or drainage water cannot drain by gravity to the main trunk sewer or treatment plant an automatic lift station is required. Illustrated at the left is the most economical installation to build employing the submerged style vertical ejector in the wet pit.

The motor is totally enclosed and equipped with a water-tite conduit box. Float switch, starters, alternator (for duplex units), and disconnect switches are all NEMA-4 water-tite.

The piping is simple and economical. Gate valves may be omitted if necessary. A check valve should be used in each horizontal discharge pipe.

Pit may be constructed of concrete tile. Pit may be as small as 84" diameter. A cover separates the wet pit and the motor room at top and an atmospheric vent pipe runs from wet pit to a point above ground. A ventilating blower may be installed for the upper section of the pit.

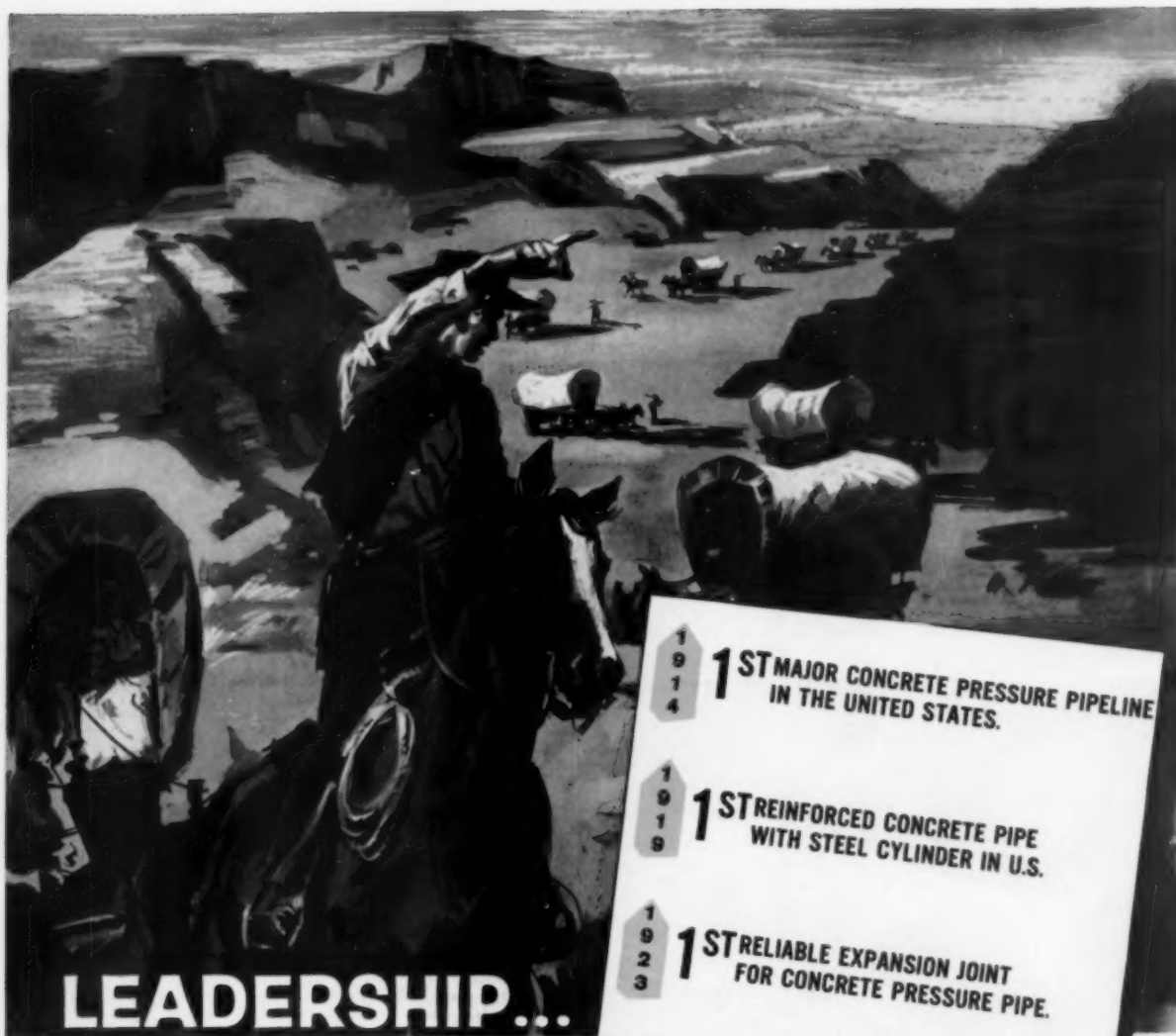
For complete specifications ask for Bulletin C-900. Weil Engineers are always available to provide technical information for your special applications.



This **NON-CLOG** Impeller built into the WEIL Sewage Pump supplies the ideal method of pumping sewage and unscreened liquids containing solids.

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Pioneering new frontiers calls for leadership. LOCK JOINT PIPE COMPANY, pioneer in the field of concrete pressure pipe, has placed its name on every important milestone that marks the industry's progress.

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1ST "O" RING TYPE RUBBER GASKET JOINT FOR PRESSURE PIPE.

1ST PRESTRESSED CONCRETE PIPE WITH STEEL CYLINDER.

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NOW— a new, NON-CYLINDER prestressed concrete pressure pipe—product of 56 years experience in the manufacture of concrete pipe, and developed through 24 years of research and 10 years of service testing in actual water works systems.

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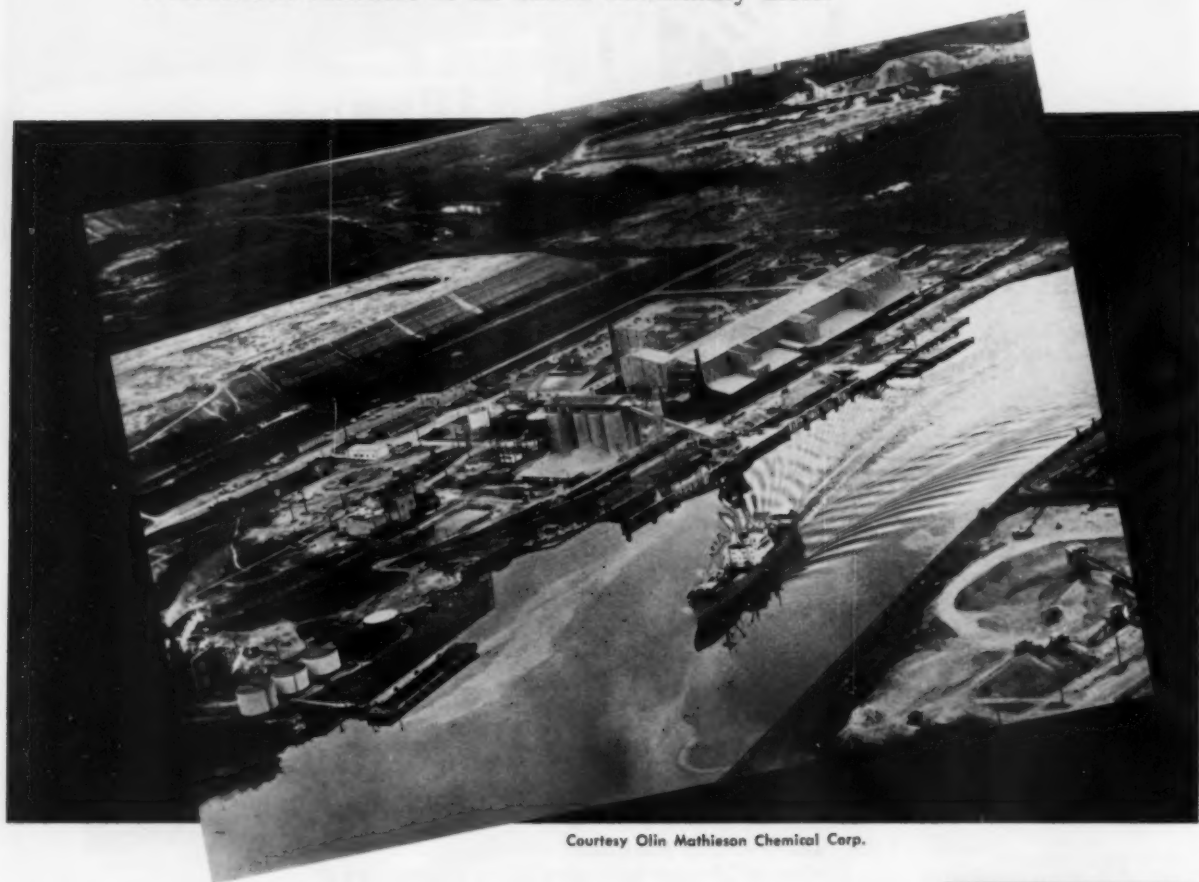
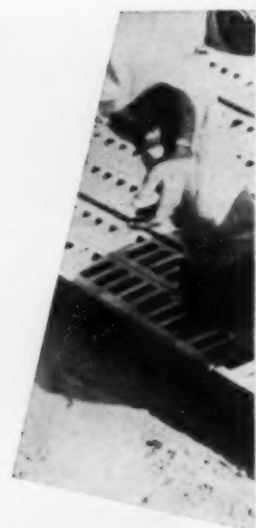
LOCK JOINT PRESTRESSED CONCRETE PRESSURE PIPE

Lock Joint Pipe Co. • East Orange, N. J.

Member of The American Concrete Pipe Association and The American Concrete Pressure Pipe Association

Boost your property values With clean waters!

Ending stream or lake pollution is an effective way to increase your city and county property and taxable values by attracting new industries. Enhances your public recreational facilities as an added community asset.

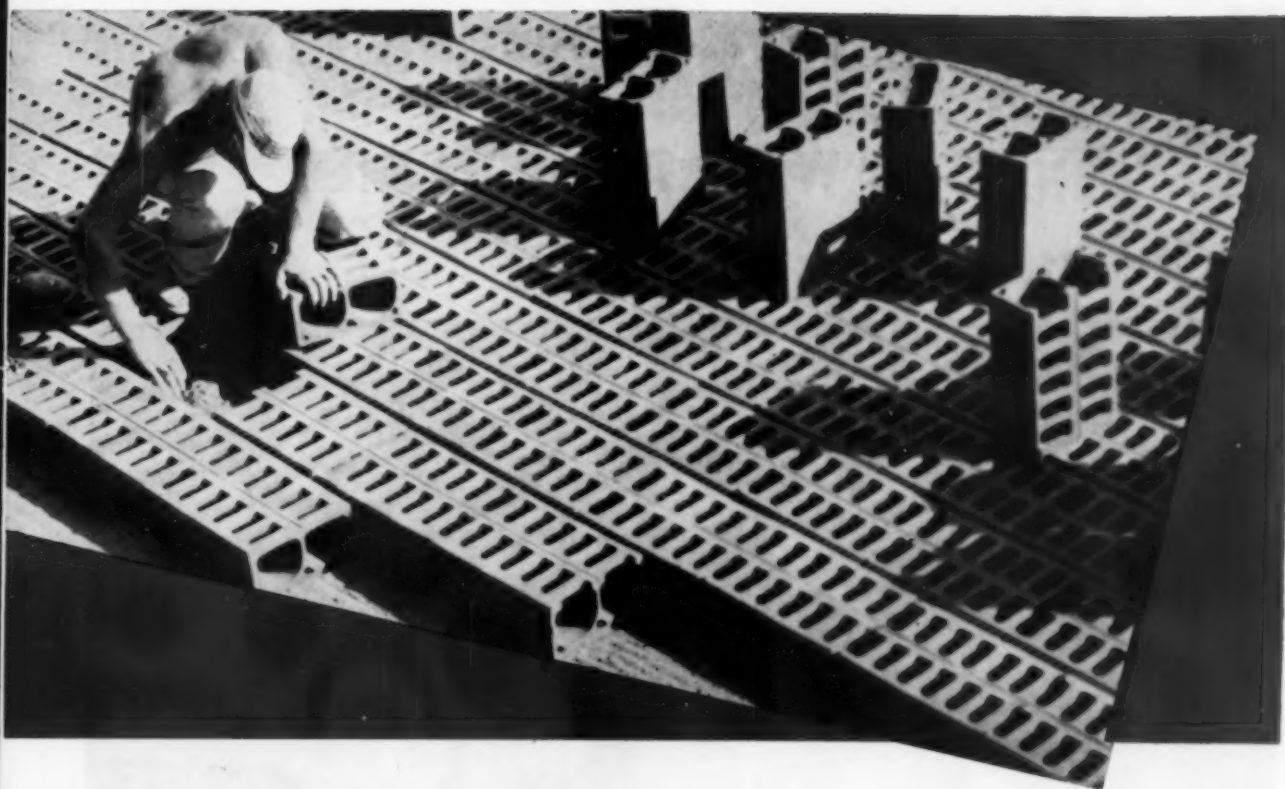


Courtesy Olin Mathieson Chemical Corp.

The best way to get clean waters

Treat your domestic and industrial wastes in modern sewage works with trickling filters. For economy and efficiency of operation and ease of future expansion these filters have no equals. Many of them built 30 and more years ago are performing as well today as when first constructed.

TFFI



The best Trickling Filters

Have floors of TFFI Specification vitrified clay underdrain blocks. Clay affords maximum resistance to ravages of acids, alkalis and bacteriological action that may play havoc with less-resistant materials.

TFFI clay block makers alone offer a 50 Year Guarantee for blocks made in modern plants under controls of quality so rigid that no substitute can even approach them in long, reliable life.

Lowest Final Cost

Final cost is the true cost, and with clay you are assured that first and final cost will be one. For clay continues to be your best insurance against costly future failures that can destroy many times over any "savings" made by using less than the best.



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Pittsburgh 22, Pa.

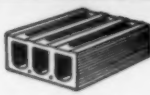
Demand CERTIFIED Underdrain Blocks

Vitrified clay block manufactured by TFFI members and tested by the Materials Testing Laboratory of Rose Polytechnic Institute comply with or exceed ASTM Specification C 159-59T. For a copy of these Specifications, see your TFFI Handbook or write nearest member for one.

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ARMCRE
Ayer-McCauley Clay Co., Inc.
Brazil, Indiana



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

Memphis Solves a Tunneling Problem



WITH ARMCO LINER PLATE



An extensive new sewer project in Memphis, Tennessee, includes 1400 feet of tunneling under several railroads and heavily-traveled Chelsea Avenue. Rather than permit the open-trench method across tracks and street, the city specified steel liner plates for tunnel work.

The tunneling subcontractor, Armco Construction Services, is installing 10 gage, 70-inch neutral axis diameter Armco Liner Plates through which the 54-inch O.D. sewer pipe will be threaded. When the threading process is complete, liner plates will be left in place and sealed by grouting. Because the installation is underground, there will be no interruption to rail or automobile traffic.



For strength,
economy,
durability

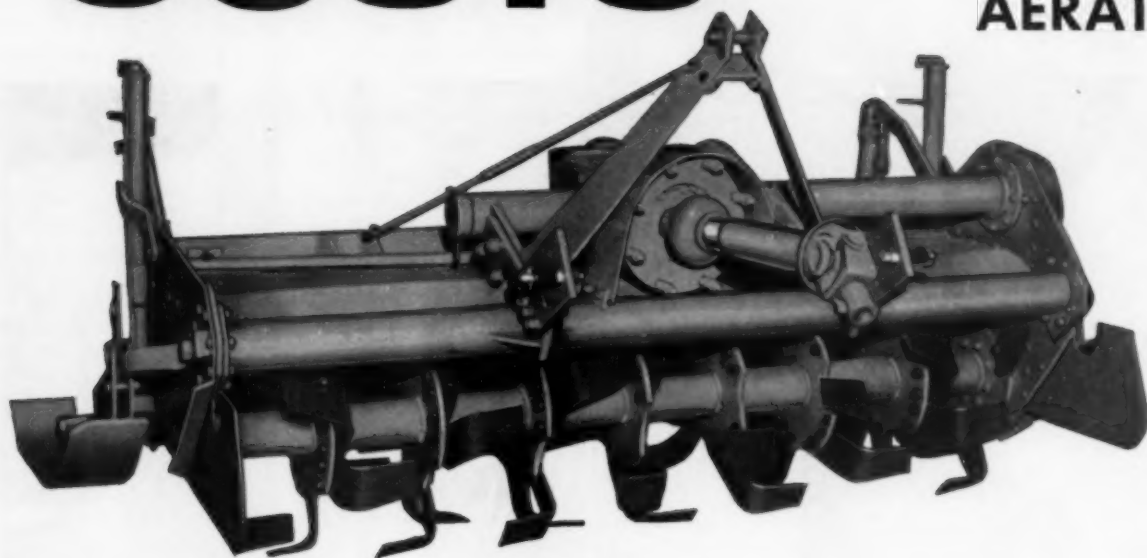
For details about how strong, economical Armco Liner Plates can help you with *your* tunneling problems, write Armco Drainage & Metal Products, Inc., Subsidiary of Armco Steel Corporation, 6831 Curtis Street, Middletown, Ohio.



ARMCO Drainage & Metal Products

CUT COSTS

MIX
PULVERIZE
RECLAIM
AERATE



NEW *Mix-in-Place* ECONOMY

The all new Howard UNIMIX is the low cost answer for mixing and pulverizing jobs of the contractor, developer or local government. UNIMIX is a power take-off blender-pulverizer designed to work off modern tractor power in the 55-80 h.p. class . . . the same power package now used for back-hoe and front end loader work.

Why pay *three, four or five* times more for self-propelled, single purpose blending equipment only to have it at expensive rest when the jobs are completed?

The UNIMIX is versatile . . . Mix and blend; pulverize and reclaim; add moisture for better compaction; aerate soil to speed production; strengthen bases and sub-bases with any additive and clear land.

**Write today for literature
and demonstration facts.**



UNIMIX 80 mounted on Massey-Ferguson 85 (butane) tractor. City street reclamation in Amarillo, Texas using dry lime.

HOWARD
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Industrial Division • HOWARD ROTAVATOR CO., INC. • Harvard 3, Illinois



There Is No More Beautiful Way

Symbols of a Modern Community...

WATERSPHERES® AND WATERSPHEROIDS®

The remarkable advances in gravity pressure water storage are demonstrated by this dramatic photo showing a modern CB&I Waterspheroid and an old riveted standpipe.

When you modernize or add to your water storage facilities, consider the advantages of CB&I Waterspheres and Waterspheroids. Developments of CB&I's imaginative engineering in steel, they identify your community as a modern and progressive place to live. Ask for Bulletin A-40, "Modern Elevated Water Tanks."

Benefits of the Watersphere and Waterspheroid Design Include:

- Minimum ground area required
- Modernistic design to blend with landscaping and natural surroundings
- Utilization of base for pumping equipment or storage
- Elimination of external ladders
- Smooth surfaces from top to bottom reduce painting and maintenance costs

500,000 GALLON Waterspheroid, at left, has a head range of 37½ feet. The bottom capacity line is elevated 100 feet.

CB&I

Chicago Bridge & Iron Company
332 South Michigan Ave., Chicago 4, Ill.
Offices and Subsidiaries Throughout the World

CB-6114



200,000 GALLON Watersphere, 37'8" in diameter, is elevated 98 feet to the bottom. Watersphere capacities range from 25,000 to 250,000 gallons.



500,000 GALLON Waterspheroid draws attention to a modern community. Waterspheroids have capacities from 200,000 to 500,000 gallons.



400,000 GALLON Waterspheroid, in the center of a new residential development, provides gravity water pressure for general service and fire protection.

To Identify A Modern Community

To get the best value
for their money

HURON CHOSE PRECAST

Concrete Structurals By A-M



Architectural & Engineering
Design by:
Herbert Fleischer, P.E.,
254 5th Ave., New York City

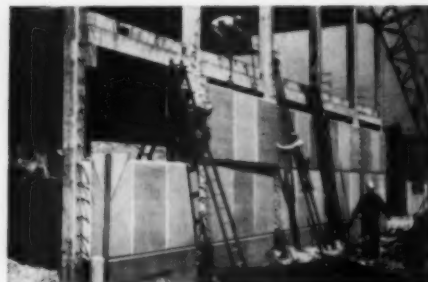
Economy, as well as speed of erection, were important considerations in the planning of this new office and laboratory addition of Huron Portland Cement Company at their Alpena, Michigan plant. That's why American-Marietta *precast* concrete structurals were chosen for the job.

The precast structural contract—including precast grade beams, columns, wall panels, beams, floor and roof slabs—was substantially completed 18 weeks after the date of its award.

If you are planning the construction of industrial buildings and warehouses, schools, offices or apartment buildings it will pay you to investigate the many advantages of specifying American-Marietta *precast* concrete structurals. Write today for illustrated literature.



The columns in Huron's 25,000 sq. ft. building are 15" x 16" in cross section by 28'-5" high (two stories).



The American-Marietta wall panels are 6" thick solid panels with a broomed surface exterior finish.



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CONCRETE PRODUCTS DIVISION

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Speed "high-pressure" through-street jobs with a 3010 Wheel Loader

With traffic pressure always high around street excavations, equipment like the new John Deere "3010"—efficient, clean-working—is a powerful asset. The unit is available with a choice of power—64 engine h.p. gasoline or 69 engine h.p. Diesel. Power steering and power brakes are standard. Constant-mesh transmission provides 8 speeds forward, 3 reverse for any power requirement.

Efficient controls boost productivity of the heavy-duty "3010" Wheel Loader and power-matched backhoes. Single-lever control operates loader lift arms and bucket for rapid handling. John Deere Backhoes operate

with simple two-lever control. Flush-digging model 51 has rotary boom cylinder which centers or slides to any of four off-center positions, moved by the unit's own hydraulic power.

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For a demonstration, contact your dealer through the yellow pages.

John Deere, 3300 River Drive, Moline, Illinois.



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BACKHOES
SIDEBOOMS
AND
CONSTRUCTION
EQUIPMENT**

EQUIPMENT AND MATERIALS

For Your Public Works Program

NEW LISTINGS

Ban That Bang of Manhole Covers

207. Folder shows how riser cushions can become an integral part of the manhole in just minutes and eliminate rattles and noise. Get folder from Utilities Supply Div., Central States Industrial Supply Co., 535 Terminal Tower, Cleveland 13, Ohio, or use our reply card.

Gratings for Sewage, Water and Lighting Plants



217. Aluminum or welded steel gratings and treads, according to your needs, are well described and illustrated in literature to help you design, specify and select. Write for file No. ATA 14-R to Grating Division, Rockwell-Standard Corporation, 4000 East 7th Avenue, Gary, Indiana, or check the inquiry card today.

Gaslifter Unit, Digester Circulator-Mixer

229. Is fully described and illustrated, with suggested specifications, included in 8-page brochure telling how the Gaslifter liquefies and completely circulates and diffuses the digester contents. Write for Bulletin 25-S-91 to Walker Process Equipment Co., Inc., 840 N. Russell, Aurora, Ill., or check inquiry card.

Weed and Brush Killer Cartoon Book

253. A novel "Western" approach is used in a cartoon-style booklet to dramatize herbicides for brush control along rights-of-way and mixed brush and weeds. Write for "Diamond Deputies." You and your kids will both profit from it. Address Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio, or use our reply card.

Improve Concrete in Water and Sewage Works

259. How to overcome severe weathering, freezing, thawing, saturation with water and chemical corrosion is subject of useful 20-page booklet. Gives owners' reports and studies of 35 installations. Write for Reporter Number 5 to The Master Builders Co., Cleveland 18, Ohio, or circle number on reply card.

"Wrought Iron for Sewage Plants and Manhole Steps"

261. This is the title of a new 8-page bulletin illustrating typical designs of manhole ladder steps, with discussion of wrought iron for such use under corrosive conditions. Ask for your copy by above name from A. M. Byers Co., Clark Bldg., Pittsburgh 22, Pa., or check reply card.

Automatic Controls For Unattended Engines

278. To start and stop engines that are unattended. The multiple element itself gives six speeds and contacts. By adding a simple attachment 18 speeds are attained. Water, sewage and power plant heads will want Catalog 6 from Synchro-Start Products Inc., 8151 N. Ridgeway Ave., Skokie, Ill., or circle the card-number.

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

Welded Steel Pipe

226. 40-page booklet with pictures, product data, and specifications, plus tables on flows, pressures and every pertinent detail connected with this pipe. Ask for Catalog WSP-859 from Armco Drainage & Metal Products, Middletown, Ohio, or check the inquiry card.

Specifying Dump Bodies and Hoists

230. Here's help in simple language for the engineer and official who has to specify equipment, from truck to body, for refuse collecting and hauling. A new contribution that has been long lacking. Write for Bulletin BH-59110 to The Heil Co., Body and Hoist Div., Milwaukee 1, Wisc., or use reply card.

Federal Specification for Cement

Coated, Mortar Lined Steel Pressure Pipe

241. Attractive color-illustrated brochure gives details on new Federal specification and describes types of steel pipe, protected fully for water service. Get it from Southern Pipe Div., P. O. Box 6, Arusa, Calif., or circle our card-number.

Your Motor Grader Operators Can Greatly Benefit

268. By the reading of new 20-page fully illustrated booklet with a world of information specifically on how to operate a motor driven grader most efficiently. Attractive and easy to read. For yours, write Gallon Iron Works & Mfg. Co., Gallon, Ohio, or use the reply card.

Pave Gutters, Sidewalks and Divider Strips

282. . . . whether bituminous or concrete. Leaflet with details, illustrations and Trac-Paver specifications is yours for the asking from Trac-Machinery Corp., Nunda, N. Y., or just use our card.

Readers Service Index

New Catalogspages 34 & 36
Water Works	pages 36, 38 & 40
Constructionpage 42
Businesspage 42
Sewerage & Waste	pages 44 & 46
Streets & Highways	pages 46 & 48
Snow & Ice Controlpage 56
Weed Controlpage 56
Dust Controlpage 56
Lighting & Trafficpage 56
Refusepage 56

Hot Roll Street Patcher

286. Brochure describes a heated asphalt roller that makes street repair work easier and more effective. Portable, fits on any truck. Motorized or hand-pushed types. Ask for Hot Roll Booklet from Ellis Distributing Co., 13 South Prairie, Liberty, Mo., or check our card-number.

Chain Link Fence of Aluminum

291. Has many advantages for you, briefly described and copiously illustrated in 12-page brochure, which includes specifications. Corrosion-resistance is the content of a special section. Many uses suggested for city, county and state engineers and officials. Ask for your copy by above title, from Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa., or use our reply card.

Smash Cans and Bottles

292. . . . to conserve storage and hauling space. Quit storing and hauling air in these empties! Four-page folder tells all about how you can do this. Just write Rescor Industries, 9 W. Prospect Ave., Mount Vernon, N. Y., for your copy, or check our reply-card.

Chlorinators

297. Compact "Advance" gas chlorinators of the solution feed, vacuum-operated type are fully described and illustrated in Bulletin 100. Address Capital Controls Co., Inc., West Point, Penna., or use our reply card.

Water Works Equipment For Filters

299. . . . all the way from filter bottoms to wash troughs and slide gates are shown in single sheet giving full catalog-references. Address Filtration Equipment Corp., 271 Hollenbeck, Rochester 21, N. Y., or check our card-number.

16 Pages of Know-How on Area Floodlighting

300. Technical booklet gives quick reference guides for selecting all types of flood lighting equipment. This booklet was an award winner selected by a group of prominent consulting engineers. Ask for Bulletin 2719 of Crouse-Hinds, Wolf & 7th North Sts., Syracuse, N. Y., or ring the number on card.

Refuse Handling System

Cuts Lifting and Carrying Work

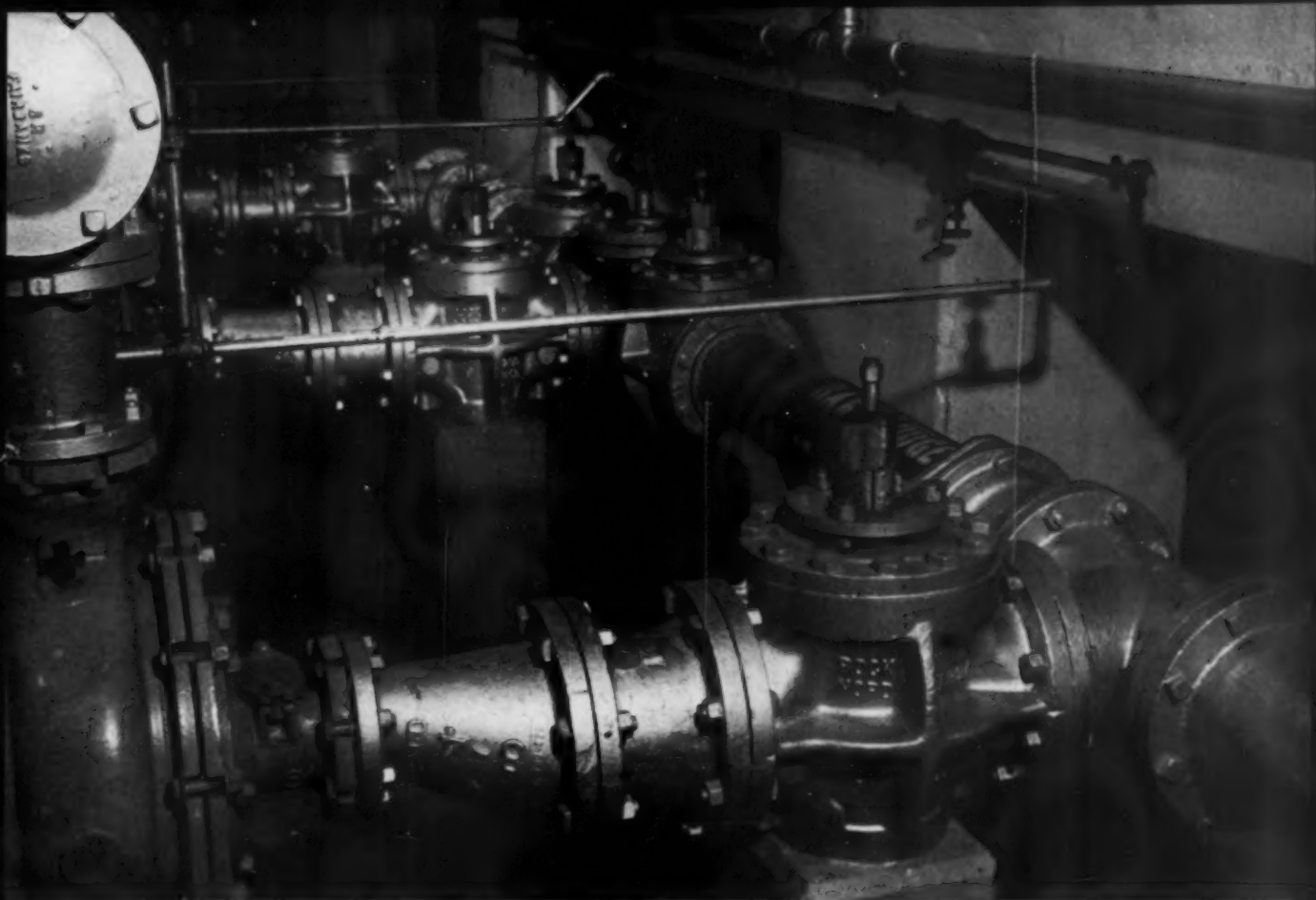
301. New features in equipment and methods, from pickup point to disposal, including a trash can consolidation system for time and labor saving plus automatic loading are all described in 4-page brochure. Address Marion Metal Products Co., Marion, Ohio, or use reply card.

If You Have Drilling to Do

312. This 80-page catalog covers complete line of hydraulic powered drill rigs, tools and accessories. Cross-indexed for fast reference, with table for determining correct GPM of drilling fluid or CFM of air for sampling and coring. Write for Catalog 615 to Mobile Drilling Inc., 900 N. Pennsylvania St., Indianapolis 4, Ind., or check our reply card.

All-Purpose Winch and Hoist

318. New bulletin shows thirteen ways of lessening labor with a winch-boist that can lift 2500 lbs. and pull 5000 lbs., yet weighs only 60 lbs.; is portable; mounts on truck, car, boat—anywhere—with just six bolts. Works off 6 or 12-volt battery or 110-volt AC. Write for My-te Bulletin M-61, City Engineering Co., Inc., 3547 Massachusetts Ave., Indianapolis 18, Ind., or use our reply card.



NEW \$100 MILLION SEWERAGE WORKS CUTS COSTS WITH LUBRICATED PLUG VALVES

Dozens of Rockwell-Nordstrom lubricated plug valves control the flow of sludge through sedimentation, concentration and incineration at the Allegheny County Sanitary Authority's new Pittsburgh sewage treatment plant. This facility, completed in 1959, is the world's largest plant incinerating concentrated raw sludge, with a flow of 150 million gpd.

The Authority's engineers chose rugged Rockwell-Nordstrom valves for one major reason: their proved performance in sewage services as-

ures long, trouble-free life and lowest valve costs.

Costly down time for stuck valves is eliminated with the Rockwell-Nordstrom design: pressurized lubricant sealing prevents solids from getting between plug and seat. This pressurized lubricant also forms a leakproof seal for positive shut-off on the heaviest sludge or the lightest gas.

Rockwell-Nordstrom lubricated plug valves are available in sizes from ½ inch to 36 inches; pressure ratings to meet your needs. Use the coupon to get complete information.



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Canadian Valve Licensee:
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Rockwell International, S.A.
81 Rue de la Servette
Geneva, Switzerland

Please send me Bulletin C-5200.

Name

Company

Street

City Zone State

To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

Rapid Sand Filter Control

310. 4-page brochure tells and shows how to fit efficient operation of rapid sand filters to system demand. In addition, literature lists five other advantages of interest to engineers and operators. Write for Bulletin 450 to Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio, or check our card-number.

Street Lighting Refractors

319. 24-page booklet goes fully into design and application factors in a way to be of utmost use to City Engineers and heads of Public Works Departments. Covers all lighting problems from residential streets to major traffic arteries. Write for "Design and Application of Lighting Refractors" booklet to Holophane Co., Inc., 342 Madison Ave., New York 17, N. Y., or check reply card.

Pump Motors and Drives

320. . . . are comprehensively covered in booklet of 20 pages to expedite your selection of the optimum motor or drive for each specific pump application. Includes condensed specification data. Indexed for fast finding of whatever data you wish. Ask for brochure F-2002 from U. S. Electrical Motors Inc., P. O. Box 2058, Terminal Annex, Los Angeles 54, Calif., or check reply card.

Catalog on

Dewatering Pumps

326. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP-0 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

Automatically Signals Ice

or Snow on Pavement Ahead

329. Enables motorists to know what is ahead before they start to skid. Applies especially to bridge surfaces. For full details, specifications and special applications, write Kar-Trol Signal Co., 12739 S. Main St., Houston 35, Texas, or use the reply card.

The Versatile Jeep

333. Inform yourself of its many varied uses and advantages with the new 4-page in-color folder showing the full line, with major specifications. Address R. J. Kreusser, Fleet Sales Manager, Willys Motors Inc., Toledo 1, Ohio, or use reply card.

For Prompt Service Use The Reply Card

A Boon to Grounds Keepers

334. A trailer that hauls, unloads and re-loads, hydraulically. Elevator lowers to ground level for one-man loading. Write for Bulletin GC-100 to Traillevator Div., Magline Inc., Box 57, Pinconning, Mich., or circle our card-number.

WATER WORKS

Equipment For Water, Sewage

and Industrial Waste Treatment

24. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

100 Page Book Helps Solve

Water Problems

71. pH and Chlorine Control. A discussion of pH, Chlorine and Phosphate Control and descriptions of comparators for making colorimetric analyses. A 100 page booklet is available by checking reply card. W. A. Taylor & Co., 7304 York Road, Baltimore 4, Md.

High Frequency Resistance— Welded Steel Pipe . .

72. Available in 6" to 16" diameters, in wall thickness to .219, special wrappings and coatings available. For attractive booklet, including specifications and details of field joints write Valley Mfg. Co., Valley, Neb., or circle our inquiry card.

Electric Submersible Pumps

75. Beautiful new full-color illustrated booklet describes most of the pumps in the FLYGT line. Just ask for "Black Magic" brochure from Flygt Corp., Hoosick Falls, N. Y., or use our reply card.

Water and Waste Treatment Instrumentation

93. Concise descriptions of all components used for pneumatic instrumentation and control of water and waste treatment operations, including primary measuring devices, transmitters, recording controllers and valve actuating devices are presented in a useful and convenient form in Bulletin I-15A of The Foxboro Co., Foxboro, Mass. Check the inquiry card.

Facts About Transite Pipe for Water Mains

121. Engineers can secure four pieces of illustrated literature that cover installation, operation and maintenance economies of Transite and Ring-Tite couplings for pressure mains. DS-335 is a material specification, TR-15A a Friction Loss of Head and Flow Powergraph, TR 62A an Installation Guide, and TR-160A in-service characteristics and case histories of water pipe. Tables of weights, sizes, pressure classes included. Address Johns-Manville, 22 E. 40th St., New York 16, N. Y., or check above number on card.

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NEW! BAUGHMAN AUGER TYPE A1-SC MOUNTABLE SPREADER



Special body that fits readily into any standard dump truck. Turn your trucks into an effective winter street fleet the minute bad weather strikes. The Baughman A1-SC distributes salt, sand, cinders . . . spreads from one-lane to four-lane widths. Just set the control in the truck cab. Positive and even flow of material from body to distributor by heavy duty auger. An 18 HP engine drives the auger and distributor. The Baughman A1-SC gives you a standby fleet, ready for winter.

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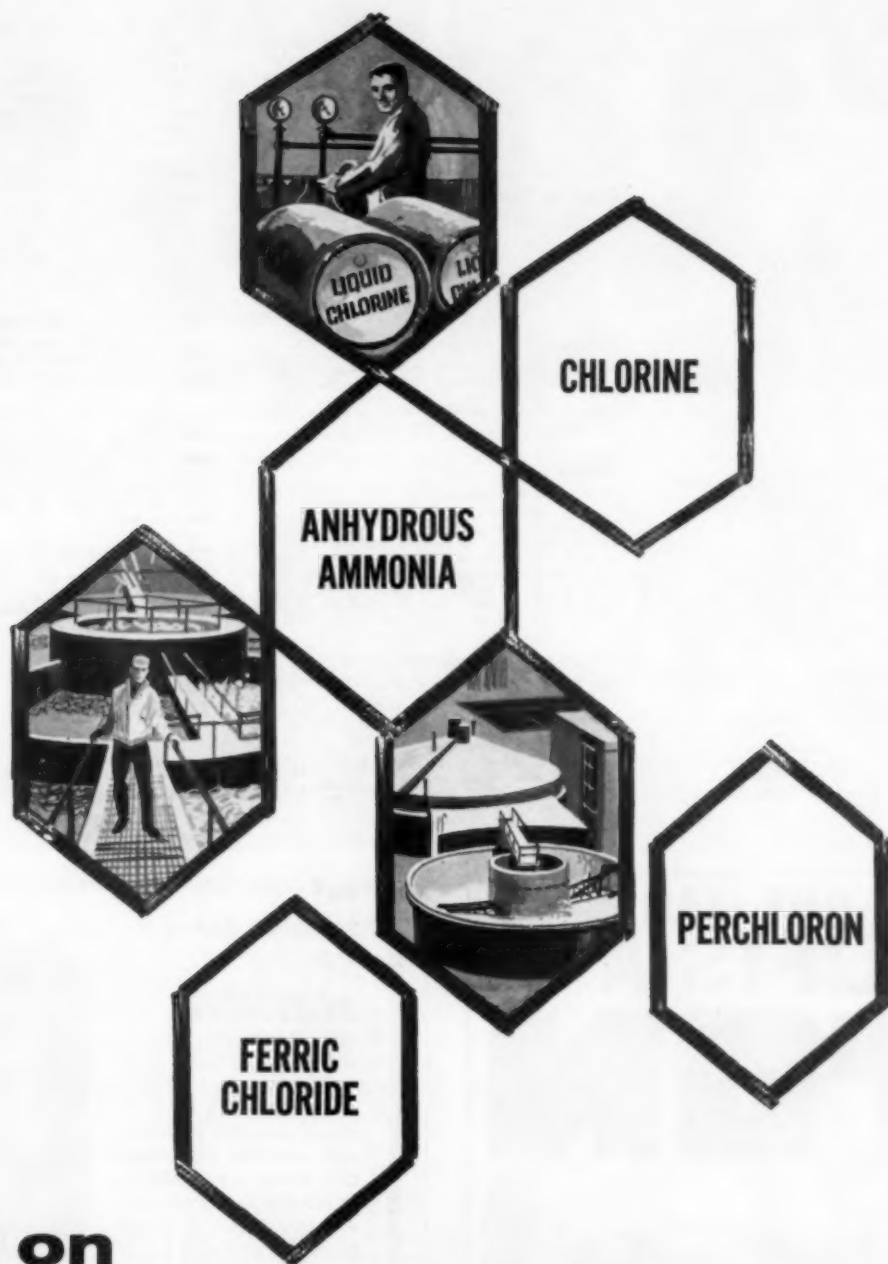
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Baughman Manufacturing Co., Inc.
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To order these helpful booklets check the reply card opposite page 34.

Valve Design Never Stands Still

106. How it has moved forward in mechanical joint tapping valves and sleeves is the subject of illustrated, specification-filled color folder which is yours on request of The Eddy Valve Co., Waterford, N. Y., or just check our card-number.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

A Short Course in Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

The Design and Function of Elevated Steel Water Tanks

179. A 20-page bulletin of engineering information with illustrations of typical installations, emphasizing ellipsoidal, radial cone and spheroidal designs, may be obtained by writing Chicago Bridge and Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. or by checking the reply card.

Engineering Data

On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Design of Prestressed Concrete Tanks

194. An 8-page technical Bulletin, T-19, on the Design of Prestressed Concrete Tanks, gives engineering data and formulas of general interest to anyone considering prestressed concrete for storage tanks. Check the reply card or Write to The Preload Co., Inc., 355 Lexington Ave., New York 1, N. Y.

Volumetric Dry Feeders

202. Bulletin gives full details on operating and design features. For valuable technical data on them write for Catalog No. 320.130 from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., or use our reply card.

Manual on

Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Meters and Instruments For Water Works

224. An attractively arranged 40 page catalog in full color issued by Hersey-Sparling Meter Co., 225 No. Temple City Blvd., El Monte, Calif., furnishes concise data on the full line of Sparling meters, indicator-totalizer-recorder instruments and other special instruments and controls. Check the reply card for your copy, or write for Bulletin 315.

Valves for Concrete Pipe

208. And no adapters needed. That is the title and the message of this new illustrated brochure in color covering this specific problem in using this type of pipe. Double disc valves with O-Ring joints are fully discussed. Get Circular No. 26 from M & H Valve & Fittings Co., Anniston, Ala., or use our reply card.

To Meet Increasing Water Demands, These Two Steps Will Help

247. Two new products designed to help meet constantly increasing demands for water are described in a folder of Hersey-Sparling Meter Co., 250 Elm St., Deham, Mass. These are a flow analyzer that provides strip chart rate of flow and volume records, and a two-rate register that can be substituted for the flow analyzer. Get this data by checking reply card.

Outline of Modern

Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaunder-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

Do You Know the Value of the V-Notch?

295. A new booklet tells what you want to know about how chlorine feeding can be made as regular and precise as the sunrise. Ask for "The V-Notch Story" direct of Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., or check the card-number.

Submersible Pumps

431. Are described, pictured and specifications given in a 12-page bulletin that also indicates their many uses and advantages. For your copy ask for Bulletin No. BJP-58-42 of Byron Jackson Pumps, Inc., 2301 E. Vernon Ave., Los Angeles 58, Calif.

ONE MAN LIFTS A TON



... OF GROUNDS CARE EQUIPMENT!

... hauls, unloads, re-loads it, too ... with Trailelevator, the amazing hydraulic elevating trailer that lowers to ground level for easy, one-man loading ... lifts its own load in seconds! Parks, golf courses, colleges, cemeteries ... if maintaining grounds is your responsibility, find out how you can get more jobs done in less time, at less cost ... with Trailelevator.

SEND TODAY FOR BULLETIN GC-100! Trailelevator Division,
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An extensive line of speed sensitive switches, with variable mountings and drives are available to suit the needs of modern equipment. A single governor containing 1 to 6 speed switches can be furnished to trip at any given range.

Switch Container Dimensions
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Available drives

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- GS ... For belt, chain, gear or coupling drives.
- GA ... Standard specification pad AND20005.
- GW ... General Motors standard for blower accessory drive.
- GO ... Direct mounting for tachometer take-off.
- GY ... Two bolt flange mounting.
- GT ... Provides 2 auxiliary drive take-offs.

SYNCHRO-START PRODUCTS, INC.
8151 NORTH RIDGEWAY AVENUE • SKOKIE, ILLINOIS



Gain an extra 1½ ft of dumping height by dumping through the bottom of the bucket. Bottom dump feature also enables the operator to control the rate of flow while spreading materials such as gravel, crushed stone or top soil.



Fine-grade with almost motor grader accuracy using scraper action. Exclusive Skid-Shoes on the bottom of the bucket help hold to grade. Your operator can even let go of the controls and still maintain precision accuracy . . . speed up work.

3/4-yard clam action *Four-in-One* *expands limited equipment budgets!*

For just a little more than the price of a conventional ¾-yard tractor loader you can have a "fleet" of equipment! Only the International® Drott T-340 Four-in-One gives you the actions of bucket, bulldozer, scraper, and clamshell, *all* in one machine.

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various pieces of equipment to become available. **You can count on dependable performance**, too. T-340 and TD-340 crawlers are IH-tough, with International's traditional built-in stamina. Fuel costs are among the lowest for crawlers in the under 50 hp class.

Find out first hand the many ways the T-340 can expand limited equipment budgets. Ask your nearby IH dealer for a demonstration soon.

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Drott Manufacturing Corp.,
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INTERNATIONAL
DROTT

Back drag with the front half of the bucket to dress banks or clean out ditches. Tractor remains on firm ground. Alternate equipment needed for doing the same jobs would cost far more.



Raise the front half of the bucket all the way and you have an efficient bulldozer. Skid-Shoes hold the blade to grade accurately . . . there's no sudden "suck in" of the blade.



To order these helpful booklets check the reply card opposite page 34.

Are You Using the Right Coagulant?

381. This question, and its answer, are included in new folder that packs much valuable guidance in water and sewage treatment. Read a little and learn a lot. Write to Tennessee Corp., Box 2205, Atlanta 1, Ga., or circle our card-number.

Manual Answers Your Water Meter Questions

440. This valuable reference covers the complete line of Trident water meters, giving full descriptions of each type and providing also helpful background information on metering and its advantages. Get your copy of the 28-page Trident Water Meter Catalog, Form 421-1, by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

Badger Read-o-Matic Register For Outside Water Meter Reading

534. The Read-o-Matic is simple to install and requires no outside power. Doorbell-type wire carries the pulse from generator in meter to the register on the outside of the building. Check the reply card or write Badger Meter Mfg. Co. 4545 West Brown Deer Road, Milwaukee 23, Wisc.

Reinforced Plastic Pipe and Fittings

549. . . . for water and sewage service, in sizes 2 through 8 inches, made of epoxy resins and glass, highly resistant to hydrogen sulfide gas, electrolysis and difficult soil conditions. Booklet tells all in 16 illustrated pages. For your copy write Amercoat Corporation, 4809 Firestone Blvd., South Gate, Calif., or circle number on the card.

A Flat Statement About Round Tanks

434. The title of a new finely illustrated booklet is "Steel Tanks Store Water Best." It gives pictures, essential data, and a fine impression of strength, water-tightness and beauty combined in sturdy structures. For your copy write Steel Plate Fabricators Association, 103 W. Madison St., Chicago 2, Ill., or check our card.

Handbook on How to Lay Concrete Pressure Pipe

524. Manual on concrete pipe laying instructions is available from Price Brothers Co., Dayton, Ohio. Check the reply card for information on how to dig the trench and handle the pipe, make the joint and the pipe bedding procedure.

To Insert Valves Under Pressure . . .

555. . . . let your first step be review of this "step-by-step" folder on Mueller tapping and cutting-in sleeves and valves. Write Mueller Co., Decatur, Ill., for Form W-8899 or circle number on our card.

Weinman Horizontal Non-Clog Centrifugal Pumps

579. Non-clog pumps for sewage and sludge in municipal plants are covered in literature from the Weinman Pump Mfg. Co., 290 Spruce St., Columbus 8, O. Specifications and dimensions are included.

The Start of Flow Metering and Control Systems

614. No single differential producer is best for all metering applications. Before specifying, be sure to check all types. Ten of them are described in detail in bulletin No. 100.20-1 of B-I-F Industries, Inc., P. O. Box 1342, Providence 1, R. I. Use the inquiry card.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for

For Prompt Service Use The Reply Card

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Water Filtration Costs Can Be Reduced

692. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.

Measure Water Accurately In Open Ditches and Channels

694. Parshall Measuring Flumes are widely used by Irrigation Companies, Farmers, Cities and Industries. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cubic feet per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights. Thompson Pipe & Steel Co., 3025 Larimer Street, Denver 1, Colorado will send you a free copy for the asking.



W&T Slaker
Saves You Hidden Water Costs

HERE'S THE SECRET OF BETTER LIME SLAKING

This torque-actuated water valve is the heart of Wallace & Tiernan's Paste-type Lime Slaker. It means easier, cleaner lime slaking . . . constant control . . . lime slaking you can do right in your plant.

Thanks to this new idea, W&T's Slaker uses less water, slakes lime completely regardless of quality or quantity, needs no pre-heating or bulky insulation. It gives you a smaller lime slaker than ever before. The 1000 lb./hr. model takes up less than 6 ft. x 2 ft.—the 8000 lb./hr. model less than 46 sq. ft.

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WALLACE & TIERNAN INC.
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PUBLIC WORKS for July, 1961

To order these helpful booklets check the reply card opposite page 34.

CONSTRUCTION EQUIPMENT AND MATERIALS

New Literature on Tractor Loaders

55. Full illustrated descriptions on Allis-Chalmers TL-12 and TL-14 Tractor Loaders are furnished in bulletins MS-1386 and MS-1373 respectively. Write Allis-Chalmers Construction Machinery Div., Milwaukee 1, Wis.

Fallacies of the "Low Bid"

78. . . . were never better exposed than in this thoughtful new booklet titled "The Best Bid for Your Budget." Reveals the hidden factors that often make the "low bid" the high bid in purchasing motor graders. For your copy of Form E014, write Caterpillar Tractor Co., Peoria, Ill., or check the inquiry card.

Heavy Jobs or Light Jobs— Ford Tractors Will Fit

203. The versatility of Ford tractors and equipment for construction is given new emphasis by the handsome new four-color, 16-page booklet that shows Ford loaders, backhoes, dozers and grading equipment in use with Ford tractors. Heavy and light loading and excavating for a variety of municipal jobs are specially featured. Get Booklet A-B-8250 from Tractor and Implement Div., Ford Motor Co., 2500 E. Maple Road, Birmingham, Mich., by checking the inquiry card.

Booklet Shows Design of Pre-Engineered Steel Buildings

271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your building needs. In a helpful four color booklet you will find details on several basic designs for community use; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co. 7321 East 13th St., Kansas City, Mo.

The Principles of Compaction by Vibration

288. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles, Calif.

Tractors and Equipment for Municipal Use

407. Specification sheets for the John Deere crawler and utility wheel tractors; also equipment for loading, dozing, mowing, sweeping and many other operations. John Deere, Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Complete Bulletin On Municipal Supplies

473. Everything from leak locators to street signs is listed in the big 100 page bulletin "Municipal Supplies" published by Darley. Hundreds of different items for all city departments are included. Get your copy of Bulletin No. 163 from W. S. Darley & Co., 2814 Washington Blvd., Chicago 12, Ill.

For Better Work All Over Town

525. Put a Bantam in your life. On trenching, excavating, street and highway work this handy versatile crane-excavator obviates using larger equipment in many cases. Saves time and dollars. Get descriptive literature from Schield Bantam Co., 301 Park St., Waverly, Iowa or circle card-number.

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598. . . . get the McGowan bulletin on a complete line suited to all municipal needs. Self-priming models in 1-in. to 8-in. size, light weight and heavy duty, centrifugal and diaphragm types. Write McGowan Pump Division, Leyman Mfg. Corp., 10900 Kenwood Road, Cincinnati 42, Ohio.

Industrial Tractors and Equipment

625. In this very complete new, catalog you will find not only a full line of equipment descriptions but the full gamut of industrial applications such as digging, earth moving, mowing and snow removal, to name a few. Your copy is available from International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or by checking our card number.

BUSINESS ADMINISTRATION

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

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by C. Mervin Palmer and Clarence M. Tarzwell

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The unpleasant truth is . . . you can use up more of your budget maintaining an undependable machine than you spend on the loader that's always ready to do your jobs.

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power shift transmissions, automatic controls, Traxcavators make good operators even better in a hurry.

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ARE MAKING OTHER
LOADERS OBSOLETE**

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All Traxcavators have the *automatic bucket positioners* that speed every cycle, do half the operator's bucket controlling. All but the 933 have *Cat power shift transmissions* that change speed or direction with a finger touch, make operator's job easier, faster . . . all day long. Direct electric starting or gasoline starting engines that assure *all-weather starts* are available. All loaders have *dry-type air cleaners* that can be serviced in five minutes.

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933 1½ yd. std. bucket — 52 HP (flywheel) Cat Diesel Engine — direct drive transmission with Cat exclusive oil clutch that outlasts other flywheel clutches as much as 5 to 1.

Production capability: 1620 tons per day*

955 1¾ yd. std. bucket — 100 HP (flywheel) Cat Diesel Engine, turbocharged for efficiency and quick response. Cat power shift transmission.

Production capability: 3320 tons per day*

977 2½ yd. std. bucket — 150 HP (flywheel) turbocharged Cat Diesel Engine. Power shift transmission.

Production capability: 4550 tons per day*

*3000 lb./yd. bank run material excavated and loaded per 10-hour day.

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922 1¼ yd. std. bucket — 80 HP (flywheel) turbocharged Cat Diesel Engine (optional gasoline engine), power shift transmission. Safe, open design.

Production capability: 2220 tons per day†

944 2 yd. std. bucket — 105 HP (flywheel) turbocharged Cat Diesel Engine (optional gasoline engine), power shift transmission. Safe, open design.

Production capability: 4240 tons per day†

966 2¾ yd. std. bucket — 140 HP (flywheel) turbocharged Cat Diesel Engine. Dual-ratio steering for work or travel. Power shift transmission.

Production capability: 5820 tons per day†

†2700 lb./yd. loose material moved from stockpile into truck or close bin per 10-hour day



To order these helpful booklets check the reply card opposite page 34.

SEWERAGE AND WASTE TREATMENT

Package Plant Provides Big-City Sewage Treatment

41. With a design based on the "Ten State Standards," the Bio-Pac employs two-stage bio-filters, primary and secondary settling and sludge digestion, all in a single corrosion protected steel shell. Design criteria for selecting appropriate sizes for residential, industrial plant, restaurant, motel and trailer court and school use are featured in Folder 2971. Also given are dimensions and installation data for 50 to 500 population equivalent plants. Write to Link-Belt Co., Colmar, Penn.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Elliptical Concrete Pipe for Sewers and Culverts

143. A 4-page bulletin is available from United States Concrete Pipe Co., 1500 Union Commerce Bldg., Cleveland 14, Ohio, on the use of elliptical pipe to obtain round pipe flow equivalents in certain areas. Check the reply card for diagrams, data charts and tables that fully describe elliptical pipe sizes and compute discharge flow rates for the full range of pipe sizes.

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 208 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

How to Save \$264 per Mile

214. . . . in sewer cleaning is the gist of a new 8-page brochure that discusses just how such savings can be accomplished. It costs nothing to find out and it may be your best investment of the day. Write for it to Flexible, Inc., 415 South Zangs Blvd., Dallas 8, Texas, or circle the card number herewith.

Sewage Pumps That Minimize Clogging

220. This is the theme of a new 4-page folder that discusses both clogging and Gorman-Rupp sewage pumps; it is guaranteed to throw clear light on this old problem and to tell what pumps can reduce its frequency. For your free copy write The Gorman-Rupp Co., Mansfield, Ohio, or circle the number on our card.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, and end suction centrifugal pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., 636 Loucks St., Aurora, Ill. Included is a pump selection guide and spigot pipe.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Div. of The Flintkote Co., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting.

Trenches for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin L-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

New Way to Clear Clogged Sewers

415. . . . is described in a circular telling what happens when ZEP Sewer Aid is introduced into sewers and industrial wastes drain lines. Claimed that not even tree roots can resist it. Inform yourself with this "Report 20," to be had from Zep Mfg. Corp., P. O. Box 2015, Atlanta 1, Ga., or just circle our card-number.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.



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PATENT PENDING

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COVER LIFTS OFF FREELY

FOR ROUND OR RECTANGULAR MANHOLES

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BRINGS MANHOLE COVER FLUSH WITH STREET

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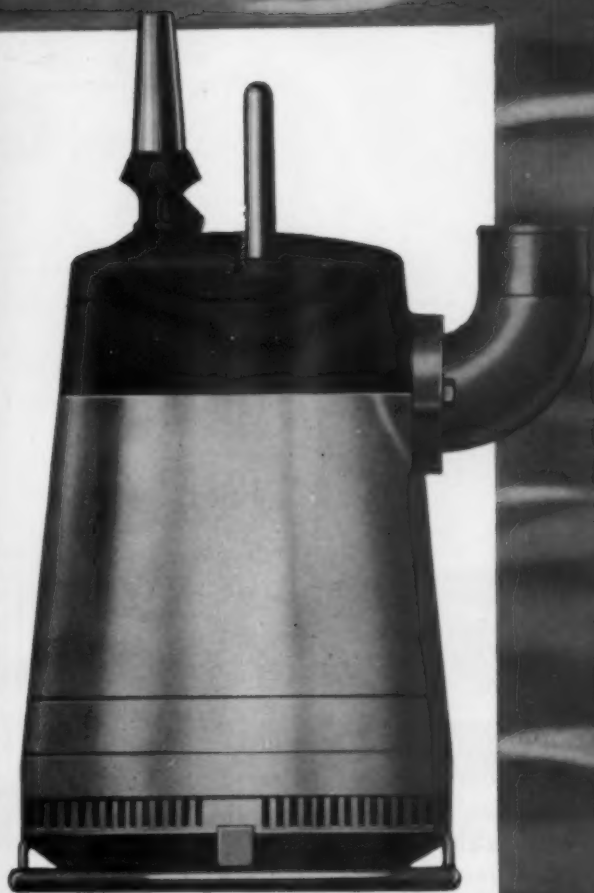
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To order these helpful booklets check the reply card opposite page 34.

Sewage Treatment Engineering Data Manual

511. This manual contains a brief outline of the various accepted methods of treating sewage and some of the problems, advantages and disadvantages of each. Check the reply card or write Smith & Loveless, Inc., Division—Union Tank Car Co., Lenexa, Kansas for design notes, charts and drawings.

Design Manual on Sectional Plate Pipes, Arches and Pipe-Arches

550. Size and weight tables, minimum gages for live load strutt and unstrutt, layout details and plan developments are some of the material covered in this manual. Write American Bridge Div., United States Steel Corp., 525 William Penn Place, Pittsburgh, Pa.

Small Unit Sewage

Treatment For 20 to 5000 People

548. Bulletin 135A describes the Rated-Aeration process, a low cost, odorless, trouble-free sewage treatment process. Check the reply card or write Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill.

Manual on Solving Drainage Problems

645. An 80-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for the third revision of this valuable book containing new tables for evaluating flow friction.

You are not Seeing Double

688. The Weil submersible sewage and sump pumps actually offer a choice of two motors, two controls. MICRO switch controls start and stop pumps, alternate pumps, and to provide high water alarm. Get Booklet SE-860 for complete engineering information from Weil Pump Co., 1526A N. Fremont St., Chicago 22, Ill., or circle card number

Bitumastic For Lasting Protection Against Corrosion

570. Bitumastic protective coatings prevent corrosion of metal and deterioration of concrete and masonry and are fully covered in catalog from Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa.

Equipment For

Sewage Disposal Plants

585. Sewage gas meters, gas regulators, lubricated plug valves and water meters are described in Bulletin C-5200-3, available from Rockwell Mfg. Co., Meter and Valve Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

Complete Data for

Complete Treatment

667. Eimco-Process Aerobic Digestion plants for treatment of organic waste waters for re-use or disposal. Sizes for the complete treatment of 3,000 to 300,000 gpd of sanitary or organic waste. Write for Bulletin PW-1010. The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, or use our handy inquiry reply card.

Useful Attachments

for "Payloador" Tractor Shovels

95. Increased versatility for Hough "Payloador" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

How Cushman Trucksters Save on Parking Meter Patrols

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103. New folder describes a compact, maneuverable pavement cleaner using only vacuum-air blast air. Sweeps path 6 1/4 feet wide. Complete details available from Tarrant Mfg. Co., 28 Jumel Place, Saratoga Springs, N. Y., or just check our card-number.

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Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.



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International Wagner Heavy-Duty Loaders and Backhoes

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Reinforced Concrete Cribbing for Highways and Embankments

267. Typical wall sections and details of standard units of open or closed face concrete cribbing are covered in catalog from American Marietta Co., Concrete Products Div., American-Marietta Bldg., 101 East Ontario St., Chicago 11, Ill. Check the reply card for general specifications and installation of the cribbing.

Road Rollers, Scrapers, Distributors or Street Flushers . . .

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Manual on Steel and Wire for Road Building

337. Design data on wire fabric for concrete pavements, joint data, cable highway guard, wire fabric, steel and wire for concrete pipe and reinforced bituminous concrete design are some of the sections covered. Check the reply card or write American Steel & Wire Div. of United States Steel Corp., Cleveland 13, Ohio, for this valuable manual.

1961 Truck Line Story From Chevrolet

446. The 1961 Chevrolet truck line is described fully in literature from Chevrolet Motor Division, General Motors Corp., General Motors Building, Detroit 2, Michigan. Check the reply card for data on this line of 165 models.

What Henry Didn't Know About Tractors and What It Cost Him

513. This is the theme of a "comic book" that has as much sound information and sense in it as it has laughs. And there are plenty of both. Moral: Ignorance is not bliss when it is costing the tractor owner money. Your men will appreciate it. For copies, write for "Henry's Crawler," to Advertising Dept., J. I. Case Co., Racine, Wis. or circle our reply card.

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConaughy Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Salt, Sand and Cinder Spreaders

532. . . . are fully discussed in folder No. A-450 outlining how these are dump body mounted for quick attachment and detachment according to service and season. Basic specifications outlined. Just address Baughman Mfg. Co., Jerseyville, Ill. or use the reply card.

For Soil Sampling and Pavement Coring

576. There's an easier way to do both with Acker equipment. Bulletin 26-R describes a kit containing 12 different soil sampling tools. Bulletin 40-R tells about the All-Purpose auger for all types of sub-surface exploration. Bulletin 700-R illustrates the Acker Shear Test Kit for in-place shear tests in soft areas. Name the ones you want. Acker Drill Company, Inc., Box 830, Scranton, Pa., or check our card.

The Tractors that Put the Utility into Utility Tractors

618. Low profile, high clearance, and a new Shuttle clutch, power steering are a few features. For the full story write Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., for Utility Tractors literature, or circle our card-number.

The Perforated Pipe You Have Been Waiting For

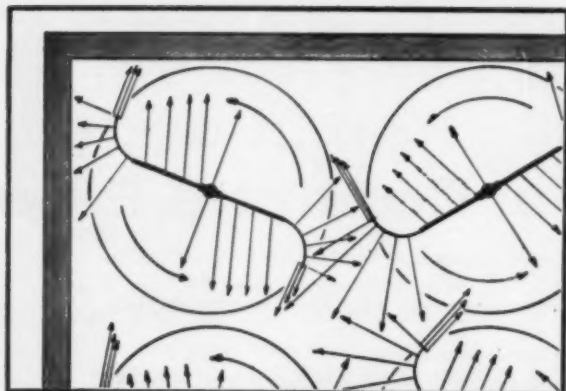
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With new S-Type arm of Agitator shown above each corner and void area receives four (4) agitating impulses per revolution instead of two . . . doubling the cleaning action in those areas. S-Type Arms can also be adapted to older units in service. Ask us for full particulars.

(Patent Pending)

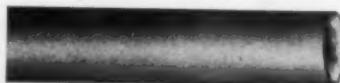
Palmer Filter Equipment Co.

822 E. 8th St.
Erie, Penn.



Authorized by A.P.F.I.
under Std. 51 and 51X
where applicable

high
frequency,
resistance
welded

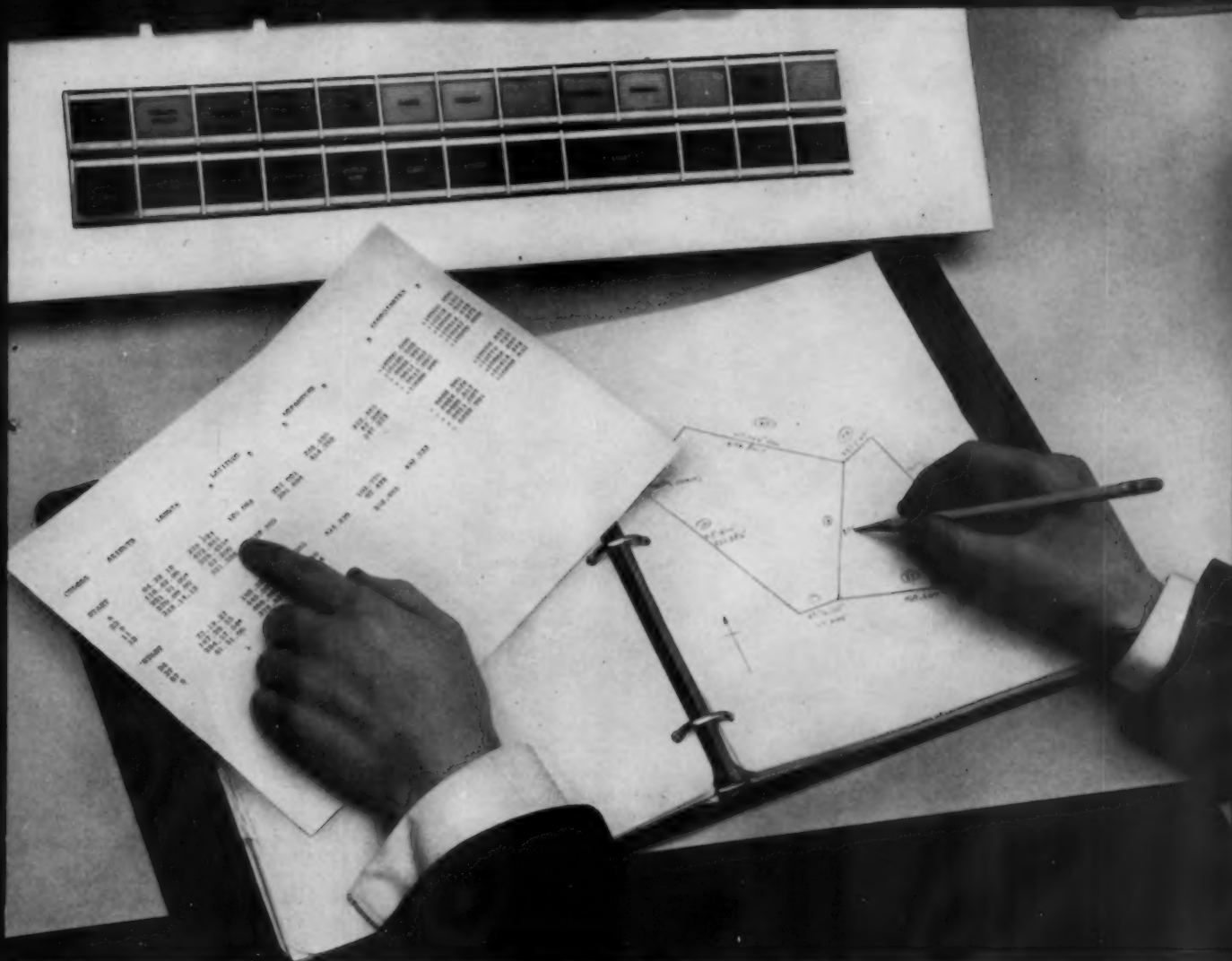


If you want a closer source for pipe that meets the highest standards, better talk to Valley. Ideal as line pipe for gas, water, air conditioning ducts, grain spouting, etc. Special wrappings and coatings. Steel piling also available.

Sizes 6 5/8" to 16" Wall Thickness to .219

write or call Dept. W

VALLEY MANUFACTURING COMPANY
VALLEY, NEBRASKA



A time-saving package for the subdivision engineer... the IBM 1620 traverse closure and curve data program

It calculates a seven-sided traverse in less than *one minute* from the time you put the paper tape in until the typewriter prints out the solution. Users of the 1620 Data Processing System can have this new program free-of-charge.

The program actually consists of two programs—*traverse closure program* and a *lot and general curve data program* incorporating the same subroutines. The traverse program will accommodate thirty-sided traverses. It will automatically select the proper method of computing the missing bearing(s) and distance(s) from among the five possible end solutions. For each course it prints

out the course number, bearing, distance, end coordinates, and the traverse area in square feet and acres.

The program is flexible—you may use typewriter or paper tape input—you can decide whether the program is to report bearing and angles in tenths of seconds or seconds.

And, you'll find that the 1620 is easy to use, fast and powerful. It's the most outstanding engineering and scientific computer in its price range. A basic installation rents for just \$1600 a month.

To learn how the 1620 can free you for more creative engineering work, call your local IBM Representative.



IBM's 1620 is a compact desk-size computer.

IBM[®]
DATA PROCESSING

Announcing

The
METER
that
took the
time
TO
SAVE
MILLIONS
FOR THE
WATER INDUSTRY

1 PROTECTS YOUR PRESENT INVESTMENT

because your older Tridents can be converted simply by replacing standard parts with new Model 60 parts, giving you the advantages of this new meter at minimum cost.

2 PROTECTS YOU FROM FUTURE OBSOLESCENCE

because it was designed and manufactured in strict accordance with Neptune's "interchangeability" policy. Will not be obsoleted by developments that are now on the drawing boards.

3 PROTECTS YOU AGAINST UNNECESSARY REPLACEMENT COSTS

because it permits you to easily and quickly repair minor damage without having to scrap major units.

4 PROTECTS YOU AGAINST LOST REVENUE

because with its easily accessible change gears, minor variations in registration can quickly be calibrated to compensate for worn parts.

**This new sealed meter
will save millions of dollars
for TRIDENT METER USERS
over the next few years.** ►

SEE FOR YOURSELF

HOW IT CAN WORK FOR YOU...

New
.....
TRIDENT model **60**
Water Meter

THE SEALED METER

*that protects your
investment because*

*it can be repaired,
reset and calibrated*

*economically
in your own shop,*

**WITH COMPLETE
INTERCHANGEABILITY
OF PARTS...**



neptune
METER COMPANY

Liquid Meter Division 47-25 34th St., Long Island City, N.Y.

TRIDENT

The
METER
that
took the
time
TO
SAVE
MILLIONS
FOR THE
WATER INDUSTRY

TRIDENT PROGRESS AGAIN PROTECTS

Here is the meter that makes progress a pleasure... everything that's new... all the advantages of the most modern sealed constructions, with a **big Neptune plus**: It can be repaired, reset and recalibrated in your

New non-fogging sealed register

HERMETICALLY SEALED... immune to moisture, flooding, mud, dust. Won't fog. Wears longer.

REPAIRABLE. No need to throw away your whole register investment just because of an accident to one part. By removing only three screws the register can be completely disassembled. Can easily be re-sealed and re-dehumidified.

REPLACEABLE CRYSTAL... sturdy glass crystal is mighty tough, but if it *should* break you can replace it for just a few cents.

POWERFUL MAGNETIC DRIVE... tamper-free... elimi-

Can be reset to zero

THE ONLY RESETTABLE SEALED REGISTER... a boon to utilities who turn repaired meters back to zero

Registration can be adjusted

CHANGE GEAR FEATURE, exclusive among hermetically sealed meters, permits adjustment of registration. No need to lose income... no need to replace expensive components just because of a

New totally enclosed gear train

WATER NEVER TOUCHES GEARS. No corrosion... less "drag"... no danger of freezing. Means long, long accurate life even in difficult waters.

NO WATER LEAKS, NO OIL LEAKS.

SEALED AND LUBRICATED FOR LIFE.

POWERFUL SHIELDED MAGNETIC DRIVE. A permanent magnet inside the sealed unit is driven by a mag-

Trident quiet flat-disc measuring element

THE FINEST, MOST WEAR-RESISTANT AND TROUBLE-FREE WATER MEASURING PRINCIPLE known to the science of metering. Remarkable sensitivity to "leak type" low flows. Unequaled simplicity. Precision ma-

model 60

YOUR METER INVESTMENT...

own shop... at low cost, with no special skills required. Parts are interchangeable... you can easily convert and modernize your older Tridents at far less than "scrap and replace" costs.

nates all rotary seals or packing glands which might cause leaks.

SWEEP TEST HAND...customer can see it move, prove to himself whether leaks are wasting water in his house. By using simple Neptune test ring which sits on top of register, meter can be tested without any disassembly.

FITS OLDER TRIDENTS, TOO. Permits low-cost modernization of all your Trident disc meters from $\frac{1}{2}$ to 2 inches. When you standardize on Trident you are sure to save time and money and protect the capital you have invested.

before placing them in customers' houses...good public relations.

little wear or mineral deposits. Keep them working years longer by use of inexpensive change gears to restore accuracy.

net below. Shielded against tampering. Cannot be disabled by magnetic particles that may accumulate over years.

FITS OLDER TRIDENTS, TOO. Interchangeable with standard Trident gear trains in all $\frac{1}{2}$, $\frac{3}{4}$, and 1-in. Trident Disc Meters made in the past 50 years.

chined to minimize effects of wear... keeps its accuracy longer. Quieter, with Neptune thrust roller and bearing plate to prevent piston slap. Replaceable half-balls. Sand ring keeps abrasives away from spindle, block, and ball.

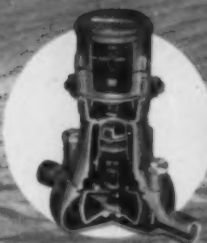
Easy to read,
has
sweep hand

Can be reset
to zero

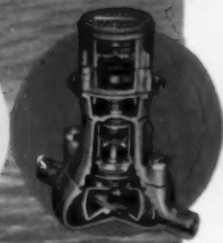
Change gears
permit
adjustment
or
calibration

Sealed
gear train

neptune



Trident Split-case meter with Model 60 sealed register and Model 60 gear train.



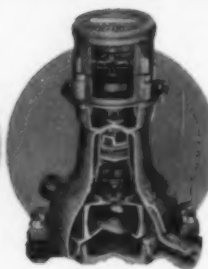
Trident with Model 60 sealed register and standard oil-enclosed gear train.



Trident with standard register (round reading or straight reading) and new Model 60 sealed gear train.



Trident with standard register (round reading or straight reading) and standard oil enclosed gear train.



Plus the same combination in Trident Frost-proof meters where freezing is a problem.

Now all these TRIDENT combinations to fit your needs

Trident INTERCHANGEABILITY protects your investment

...now and in the future.

Suddenly all your Tridents are modern as tomorrow. Trident's exclusive interchangeability lets you substitute the new Model 60 Sealed Register and/or Model 60 Sealed Gear Trains in any of your older Trident Meters. When, after test, you decide one or both of these new magnetically driven sealed units will reduce overall operating costs in your system, you can immediately start a program of modernizing your older meters.

Trident Model 60 Dimensions & Rates of Flow

SPLIT CASE METERS



FROST-PROOF METERS



SIZE	A LENGTH IN.	WIDTH IN.	C BASE TO CENTER-LINE OF PIPE	D HEIGHT, IN.		*APPROX. WEIGHT LBS.	RATE OF FLOW
				MODEL 60 REGISTER	STANDARD REGISTER		
½ (and ¾ x ¾)	7½	5	1	8½	7¾	10½	20
¾	9	5½	1½	9	8½	12	30
1 (and 1 x 1¼)	10½	7½	1¾	9½	8¾	20½	50
½ (and ¾ x ¾)	7½	5½	1¾	9¾	8¾	11½	20
¾	9	6	1¾	9¾	8¾	15½	30
1 (and 1 x 1¼)	10½	9¾	2	10½	9½	27½	50

*Weight varies by a few ounces depending on register and gear train selected.

neptune
METER COMPANY

Liquid Meter Division
42-25 34th St., Long Island City 1, N. Y.

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Montreal, Quebec • Vancouver, B. C. • Halifax, N. S. • Winnipeg, Manitoba

*Everything that is newest
in a water meter is in*

TRIDENT *model 60*

*...and interchangeability
can work for you now!*

All the advantages of the New Model 60 can be built into your system right now. The "interchangeable unit" principle on which all Trident Meters are designed and manufactured makes it possible to integrate the Model 60 into your present system without jeopardizing present or future investments in meters.

At very low cost, all present users of Trident Meters can have all the advantages of a sealed meter by just adding the Model 60 Register and Sealed Gear Train to any Trident.

When you order Trident Meters, the investment of your company or your taxpayers (for which you are responsible) is protected all ways... past, present and future. You don't need to anticipate scrapping Model 60 meters because of *later* improvements. The Model 60 has today anticipated and is adaptable to future developments not yet off the drawing boards.

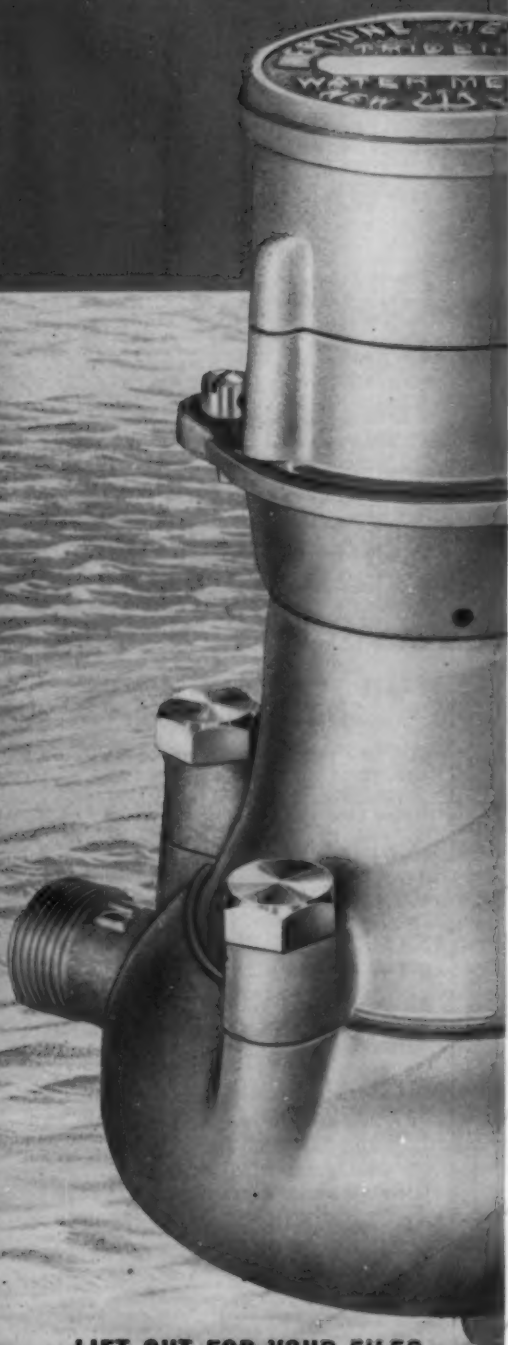
And for those users who prefer the standard Trident Meter, these fine meters will still be manufactured. Standard gear trains and registers will be available as before, both as new meter components and as repair parts.

TAKE THE FIRST STEP TODAY...

The new Model 60 can produce some impressive savings in your operating costs... eliminate lost revenue... and give you better over-all operating efficiency. A discussion with a Neptune representative will show you how Trident Model 60 meets your specific requirements. For further information write or phone Neptune Meter Company, Liquid Meter Division, 47-25 34th Street, Long Island City 1, N.Y. or the nearest Neptune District Office.

LIFT OUT FOR YOUR FILES:

**THIS FOUR PAGE INSERT GIVES YOU
QUICK BUYING FACTS.**



To order these helpful booklets check the reply card opposite page 34.

SNOW AND ICE CONTROL

Safe-T-Salt

For Ice Control

237. Safe-T salt described in this new Bulletin B-960K. Tells what this salt will do and why, and where to get it. Also the bonus you get from using salt for summer road stabilization projects. Address Morton Salt Co., Industrial Div., 110 N. Wacker Drive, Chicago 6, Ill., or use our card.

Snow Plows For Snow Control

339. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9 1/2 ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

WEED & DUST CONTROL

How to Stop

Bothersome Dust

90. A pocket-size booklet gives answers to this common problem. Lists places where calcium chloride can help. Includes some unique ones that may especially interest you. Write for booklet by name, as above, to Wyandotte Chemicals Corp., Wyandotte, Mich., or circle our card-number.

Kills Aquatic Weeds but Not Fish

156. A handy folder tells all about Penco Aquathol to kill weeds around lakes, waterfronts, fish ponds, etc. Destroys underwater weeds, floating weeds and algae fast. Ask for Aquathol folder, direct from Agricultural Chemicals Div., Pennsalt Chemicals Corp., 2901 Taylor Way, Tacoma, Wash., or check our card.

REFUSE COLLECTION AND DISPOSAL

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletins W-200, W-220 and W-221 explain how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card.

Select Your Incinerator Scientifically

275. Here is a new swift simple way of selecting the correct industrial, institutional or business-use incinerators for various types of installations. The device is somewhat like a slide rule and takes in the variable factors which determine choices in incinerators. Get yours from Morse Boulder Inc., 80 Fifth Ave., New York 11, N. Y., or check number on our card.

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Sweeper Refill Fibers

367. Here's a dependable source of power sweeper refill fibers, including domestic and imported types and gutter broom wire. To get all the data write A. Steiert & Son, Inc., Hatfield, Pa., or use our reply card.

New Dempster Book

507. . . . tells the full, illustrated story of what Dempster Brothers offer in the way of wastes collection, containerization and disposal equipment. 28 pages in color. Get your copy from Dempster Bros., Knoxville, Tenn., or circle our reply card.

Custom Engineered Refuse Trucks

686. Start-and-stop garbage and refuse collecting trucks lead a hard life. It is better if they are engineered for it. Information on the "Reo C-Series" can be had by addressing Reo Motor Truck Div., 1331 S. Washington St., Lansing 10, Mich., or by using our reply card.

STREET LIGHTING AND TRAFFIC CONTROL

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Complete Line of Traffic

Signals and Control Equipment

380. A full line of traffic signal and control equipment is covered in the comprehensive catalog of Econolite Corp., 8900 Bellanca Ave., Los Angeles 45, Calif. Wide choice of components offers economy and flexibility to suit future requirements. For more information write direct to Econolite or use the convenient inquiry card.

Literature on Reflective Glass Beads

571. Glass beads for traffic signs and street name signs as well as sign head dispenser equipment, are described in literature available from Flex-O-Lite Mfg. Corp., 8301 Flex-O-Lite Drive, P. O. Box 3066 (Alton Bldg.) St. Louis 23, Mo. No. 831 high index of refraction glass beads for white and yellow backgrounds and UH 68 medium index of refraction glass beads for reflecting dark colors such as red, green, blue, etc.

Let Progress Hit Your

Highway Signs, too

575. An overlaid plywood especially engineered for highway sign construction is now available in natural surface for reflective overlays, also in green, white, red and blue. AASHO approved. Resistance to damage cuts maintenance costs. For GPX description and specifications write Georgia-Pacific Corporation, Equitable Bldg., Portland 4, Oregon, or circle number on our card.

Modern Waste Disposal DEMANDS MODERN INCINERATORS

You tell us— We'll tell you—

Tell us the population of your area. We'll tell you frankly why incineration is the best answer to your waste disposal problem . . . the type and size incinerator needed . . . Approximate construction and operating costs. No obligation.



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For over 60 years, Roberts Filter Manufacturing Company has supplied water purifying equipment vital to the needs of municipalities and industries throughout the Western Hemisphere.

the nameplate of dependability—



ROBERTS FILTER MANUFACTURING COMPANY
640 COLUMBIA AVENUE, DABRY, PA.

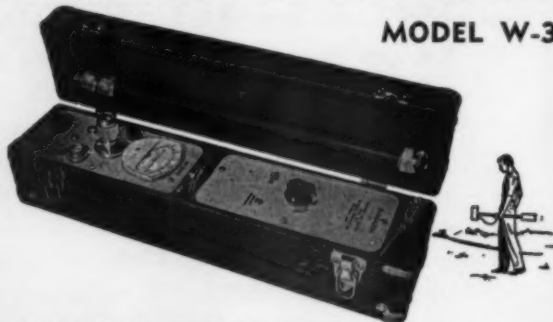
NEW MINIATURIZED WILKINSON LINE LOCATOR

MODEL W-3

Radically new, powerful, transistorized locating instrument weighs only 4 lbs. and is 1/4 as large as old type pipe locators.

Telescoping aluminum handle; 2 oz. single ear set; all in carrying case.

Write today for brochure and instruction manual.



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Architects and Engineers / Bail-Horton & Associates, Fort Myers, Florida

Beauty and Space

on a modest budget

...WITH NEW BUTLER BUILDINGS

There's something very special . . . something unprecedented about buildings by Butler. They're tailor-made for fun, with beautiful exteriors . . . spacious interiors.

The outside of your new Butler recreation buildings will gain immediate community acceptance. They literally invite people inside. You have your choice of the three finest, most beautiful curtain wall systems ever offered for pre-engineered buildings . . . field insulated Butlerib®, factory-insulated Monopanl®, or the exciting new Modular Wall. All are available in sparkling, protective Butler-Tone™ colors that offer you lasting, maintenance-free beauty.

Inside, Butler's clearspan interiors offer unlimited space for every type of community activity. Auditoriums, swimming pools, skating rinks, gymnasiums, bowling lanes, exhibition halls can all be easily housed within a Butler column-free building.

Best of all, you can build a Butler building on a modest budget, with the exceptional economies of pre-engineering and factory-fabrication.

Before you build a recreation building, be sure to contact your Butler Builder. He has an intimate knowledge of local building conditions, and building techniques based on many years of national experience. Ask him about Butler's attractive financing plan, too. He's in the Yellow Pages under "Buildings" or "Steel Buildings." Or write direct.



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SAVES MONEY, SAVES FUEL, SPEEDS WORK: 80 lb. tool hits top wallop with 34 hp compressor engine running less than 1750 rpm.

Best small compressor buy on the market

JAEGER 75

**costs much less to own and
operate than an "85" . . .
and is a better size to run an
80 lb. breaker.**

(Maintains full 90 psig at the tool)

A HEAVY PAVEMENT BREAKER USES LESS THAN 75 CFM OF AIR:
Actually, 72 cfm is all you need to operate an 80 lb. tool
at full speed and wallop, maintaining 90 psig at the tool.

Contractors, utilities and public works departments that
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runs 3 backfill tampers or 2 clay spades at their top efficiency.

Jaeger also builds an "85" for work that requires it.
Both models are fully equipped with automatic blow-down
valve, tool boxes big enough for a full set of tools and
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Worldwide sales and service through Jaeger International Corp.,
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85 — Single Stage
125 — Two Stage

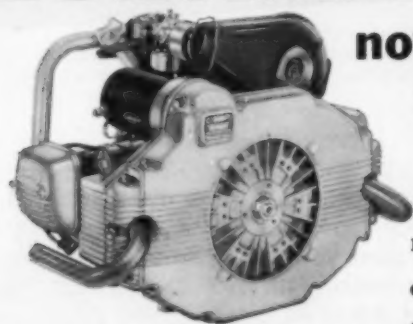
250 — 2 or 4 Wheels
365 — GM 4-71 Diesel

600 — GM 6-71 Diesel
900 — GM 6-110 Diesel

nearest thing
yet to
**COST-
FREE** →
transportation



CUSHMAN TRUCKSTERS.



now with new, more powerful,
die - cast aluminum engines!

Cost-cutting Trucksters now deliver more live power, more efficiency, more versatility and utility with either of two great new, advanced, die-cast aluminum engines:

- The OMC Twin Super Husky; two cylinders, rated at 18 HP.
- The OMC Super Husky; one cylinder, rated at 9 HP.

ACTUAL TRUCKSTER COST ANALYSIS NOW AVAILABLE

A coast to coast survey of typical Truckster users not only proves greatest economy, but reveals the wide range of uses to which the Truckster is being put.

Municipal uses ranged from mosquito control to park, cemetery and golf course maintenance... from trash collection to police and utility department service. Operating costs reported by municipal users ran as low as 0.66 cent a mile, and averaged 1.17 cents a mile.

Survey results have been compiled in condensed form and are available upon request.

Cushman Trucksters also now offer many other new advances — such as an extra-heavy duty clutch, synchro-mesh transmission, and auxiliary transmission* — to go along with these proven advantages... "all-muscle" chassis and body with 800 pound payload rating... greatest economy resulting from low initial investment, minimum operating and maintenance costs... general utility indoors or out, on or off street.

**Auxiliary Transmission optional; increases drawbar pull; eliminates strain of repeated starts and stops; produces smooth cruise at low speed. All-weather cab also optional.*

Ask your dealer for a demonstration
or write for **FREE Cost Analysis
Report and descriptive literature**



CUSHMAN MOTORS 1028 No. 21st, Lincoln, Nebraska
A subsidiary of Outboard Marine Corporation

Please send Cost
Analysis Report
and descriptive
literature.

NAME _____

TITLE _____

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STATE _____



**BROADER
WARRANTY
.....
GREATER
ECONOMY
AND
DURABILITY
'61 FORD TRUCKS**

The new extended warranty for all 1961 Ford Trucks is just one example of the many ways Ford gives you maximum protection for your truck investment. Each part, except tires and tubes, is now warranted by your dealer against defects in material or workmanship for 12 months or 12,000 miles, whichever comes first. Warranty does not apply, of course, to normal maintenance service or to the replacement as normal maintenance of such items as filters, spark plugs and ignition points.

The excellent fuel economy of Ford's modern 223-cu. in. Six has been proved in certified tests by independent experts over a 3-year span. Front tires on Ford conventional $\frac{1}{2}$ -tonners also lasted up to twice as long as those on other makes with independent suspension.

In addition to price, fuel and tire savings, 1961 Ford Trucks provide greater freedom from nuisance problems that crop up with other trucks. Ford's rigid quality controls give you the strongest safeguard of truck reliability ever. Fords stay on the job... out of the shop!



F-100 Chassis-Cab models have new stronger frame for greater durability and longer wheelbase for smoother ride. 28% more glass area in cab gives you new wide-angle view to front, sides and rear.



New Econoline Van . . . modern cab-forward design gives as much as 80 more cubic feet of cargo space in nearly three feet less length than leading conventional half-ton panels. It's America's lowest-priced* van and can cut yearly operating costs by \$100 or more.



New 4-wheel drive pickups . . . priced to save you plenty, Ford's 4 x 4's come in 1/2- and 3/4-ton capacities. They're tougher than ever with stronger frame, improved suspension and new optional heavy-duty front axle on 3/4-tonners.

*Based on a comparison of latest available manufacturers' suggested retail prices

**ALL-NEW
FORD "BIG SIX"
262-cu. in. engine**



Now, the economy of a Six is combined with the dependability of heavy-duty, exclusive-truck engine design. In independent tests, Ford's new Big Six was pitted against the major competitive Six. Certified† result: Ford Trucks gave 13.5% better gas economy! And Ford recommends 34% fewer service operations in 25,000 miles of customer service. This means less time in the shop . . . more time on the job.

The new Big Six is one of four engine choices in Ford F-600 trucks for '61—including America's most popular truck V-8's.

†Tests simulated typical city delivery and shuttle service

FORD TRUCKS COST LESS

SEE YOUR FORD DEALER'S "CERTIFIED ECONOMY BOOK" FOR PROOF!

FORD DIVISION, *Ford Motor Company*





PILE ON THE FILL — it's corrugated galvanized steel culvert

This rugged, heavy fill—43 feet of it—poses no problem for the 42-in. culvert made from 8-gage Beth-Cu-Loy galvanized corrugated steel sheets. That's because a culvert made of Beth-Cu-Loy is strong yet flexible enough to deflect with the fill, thus tending to equalize the load peripherally.

Flexibility also permits corrugated galvanized steel pipe to take the impact and vibration of heavy traffic. Corrugated steel withstands sharp weather changes and settling fills. It simplifies grading and alignment, and is easy to install without need for heavy equipment.

Beth-Cu-Loy sheets conform to the rigid specs of the AASHO. Rolled from open-hearth steel, these sheets contain copper for extra corrosion resistance. They are galvanized in Bethlehem's modern facilities with a 2-oz triple-spot test coating of Prime Western zinc. Your fabricator will be glad to give you complete details.

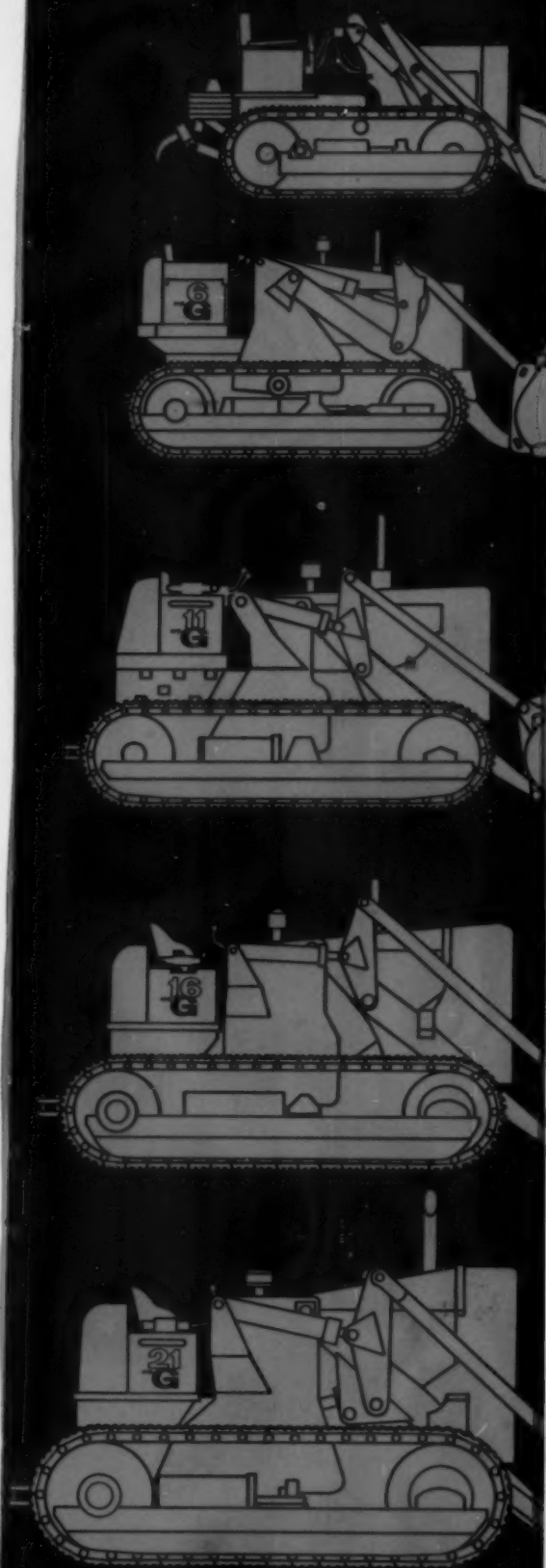


for Strength
... Economy
... Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL





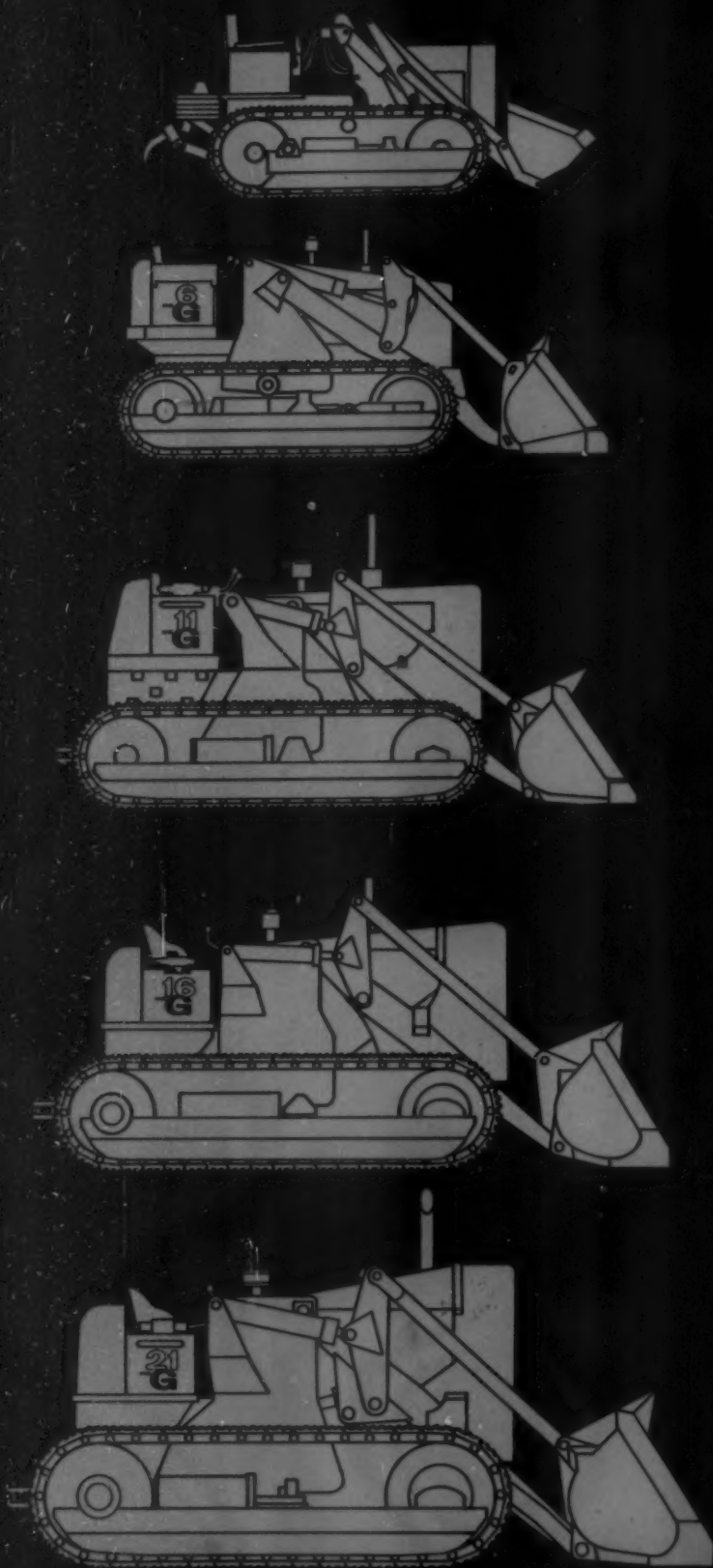
**STEP UP
YOUR
TRACTOR
SHOVEL**

Performance
Operator comfort
Wearability
Ease of maintenance
Reliability



**WITH
ALLIS-CHALMERS**

Analyze the tractor shovel news on the following pages and see how you get the top value to which Allis-Chalmers is committed. This is the result of project "power"—a massive Allis-Chalmers research and development program that brings you the benefits of significant product improvements.



ALLIS-CHALMERS

The line that offers the widest choice in

in POWER

Choose the power of an outstanding engine from 40 to 225 horsepower, diesel combustion, electric starting, with many optional designed specifications.

in CAPACITY

Select from a wide range of lifting capacities, from 1,000 to 10,000 pounds.

in ATTACHMENTS

Timesaving, tailor your Allis-Chalmers specialized applications including rockers, rock forks; skid steer and forks; power booms and buckets.

in OVER-ALL VALUE

Here is the outstanding value. Compare size, your choice with which of the built-in quality on your jobs.

Turn to the following pages
for FACTS on how you can save

ALLIS-CHALMERS

offers you the best in the industry

the power that's right for your work from
standing line of tractor shovels ranging
to 225 hp. In every unit, you'll get clean
ion, efficient power, low fuel consump-
h modern Allis-Chalmers diesel engines
specifically for heavy-duty shovel service.

om a range of buckets from $\frac{3}{4}$ to $7\frac{1}{4}$ yd
g capacities up to 40,000 lb.

ing, production-boosting attachments
ur Allis-Chalmers tractor shovels to spe-
pplications. A wide variety is available
r rock, slag and light materials buckets;
ts; straight and angle dozers; lift tongs
s; pulpwood loaders; crane hooks; side
ad back hoes.

he outstanding value line in the industry.
size, weight, horsepower, features, and
ice will be Allis-Chalmers. Regardless of
these tractor shovels you choose, the
quality insures you of top performance
obs at lowest possible cost.

Step Up Your



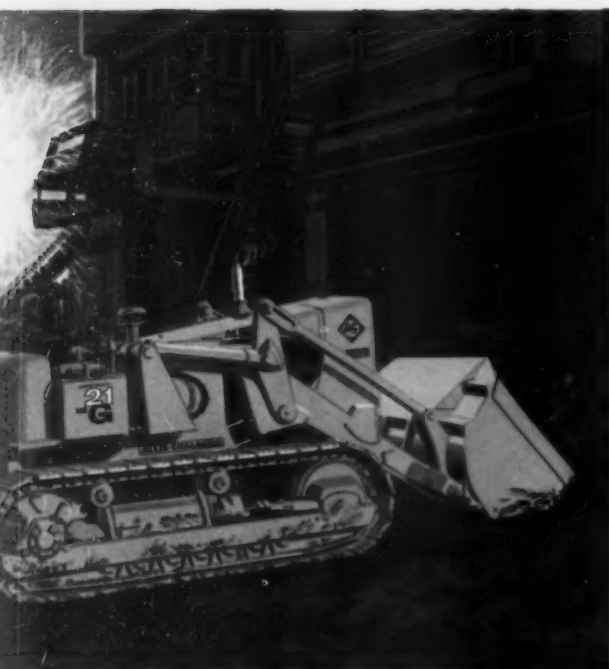
Now! Five ALLIS-CHALMERS tractor shovels

**225-hp
4-YD
HD-21G**

Both feature the "industry's healthiest engines" — the 21000 and 16000 . . . torque converter drives . . . power-operated oil steering clutches and oil-cooled "POWER" brakes. Transmissions in both units are pressure-lubricated with continuously filtered oil. You get capacity available in no other tractor shovels, plus proven fuel economy and improvements designed to extend service life while reducing maintenance requirements.

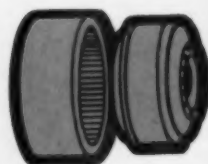
**150-hp
3-YD
HD-16G**

**111-hp
2¼-YD
HD-11G**



Steel mill stamina now standard on HD-21G

Allis-Chalmers engineers worked with steel mill designers to design a tractor shovel that could perform the extreme heat and other torturous conditions encountered on slag removal work. The result was a bigger, tougher HD-21G. This new shovel is more than two tons heavier than its predecessor. Here's a machine that will withstand the rigors of steel mill service . . . it will certainly give you with its ability to produce a tremendous volume of work on your regular big-shovel jobs, no matter how tough they may be.

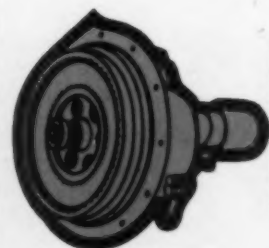


NOW!
a major
design advance

New oil steering clutches and oil-cooled power brakes on the HD-21G and HD-16G give you new standards of performance . . . new peace of mind regarding maintenance and service life. Both clutches and brakes run in a complete bath of oil so heat is dissipated with extreme efficiency, giving you exceptionally long life with minimum brake adjustment . . . no clutch adjustment. New power steering and power brakes reduce operator effort, fatigue . . . help him maintain maximum production all day.



Power-brake
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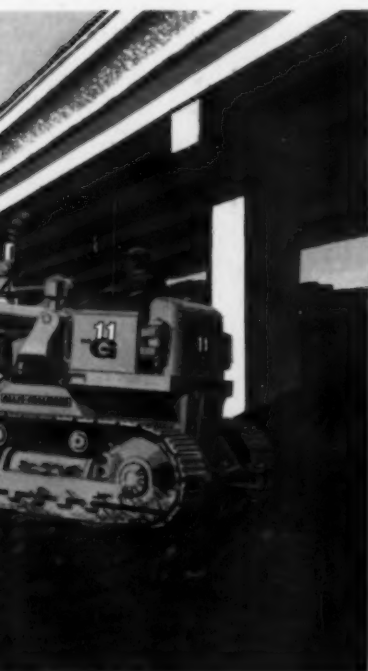
Oil master
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to match your job requirements

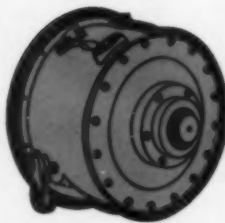
Both the HD-6G and the HD-11G feature the *fuel-sipping*, high-efficiency engines, counterparts of the 16000 and 21000, that reduce fuel consumption up to 27 percent over ordinary diesels. Both are available with your choice of oil or conventional dry-type master clutch. The HD-11G has power-booster hydraulic steering and your choice of torque converter or all-gear drive. Both units are equipped with track-guiding truck wheel guards to protect vital track parts . . . extend life.

72-hp
1½-YD
HD-6G

NEW ¾-YD
HD-3 40-hp diesel engine
H-3 43-hp gasoline engine



Power-booster hydraulic steering—clutches—with finger-tip, double-type levers are standard on the new HD-11G. The clutches are large-diameter, multiple-disc type with bi-metallic friction surfaces. Hydraulic-boosted controls provide easy operation.



Hydraulic torque converter or conventional all-gear drive can be specified on the new HD-11G. This torque converter's outstanding fluid transfer of power automatically matches tractor speed and power to load and terrain. Operators get much more work done with less effort . . . less fatigue. The hydraulic cushioning of the torque converter protects tractor components and equipment from shock and strain.

Master clutch is available in HD-11G and the HD-6G. Allis-Chalmers clutch is extra-heavy-duty with metallic plates providing plenty of reserve capacity for cool operation—less wear, longer life. Both independent oil reservoirs filter.



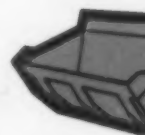
10000 engine powers the HD-11G. The 6000 engine is featured in the HD-6G. Both are fast-starting, responsive, with high torque for top performance in today's tough service. They are open-chamber, controlled-combustion engines delivering high output without even breathing hard.

big performance in a compact package

Both of the 4-cylinder engines, 149-cu-in. gasoline and 175-cu-in. diesel, provide high torque with plenty of lugability for top performance at low cost.

Oil-type shuttle clutch lets you go forward or reverse simply by moving a single lever . . . no foot clutching or gear shifting necessary. Transmission has four gear speeds . . . forward and reverse. Select your working speed and work away simply by moving shuttle clutch lever back and forth.

Two buckets are available . . . 66-in., ¾-yd and 60-in., ¾-yd. The loader produces more than 8,000-lb break-out force . . . lifts 3,600-lb, 10-ft high.



you get all the

BASIC

ADVANTAGES

that have made

Allis-Chalmers

the leader

in Tractor Shovels

In 1947, Allis-Chalmers introduced the truly successful hydraulically controlled tractor shovel revealing entirely new concepts in earth moving and material handling. Called the HD-5G, it was engineered as a complete unit with the speed, strength and capacity to handle an infinite variety of excavating and loading jobs.

Through the years, Allis-Chalmers increased this leadership as it improved and expanded its tractor shovel line to meet modern job requirements. Recognized advantages, like tractor and shovel design, a unit for exceptional strength and visibility . . . advanced linkage design for outstanding reach and stability . . . curved bottom bucket with big pry-out action . . . reflect the company's leadership. The ever-lengthening list of firsts in basic tractor features like torque converter drive, unit construction and extended lube intervals, are a few of the many reasons for the company's continuing reputation as the *house of quality*.

For digging and loading all materials at a lower cost than ever before, go with the leader—Allis-Chalmers. Nothing matches design quality, solid construction, operation ease and maintenance simplicity for long dependable performance.

*Plus everything that's new
to step
up your*

Performance
Operator comfort
Wearability
Ease of maintenance
Reliability



ES

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Your Allis-Chalmers dealer
is in business to . . .

PROTECT YOUR EQUIPMENT INVESTMENT WITH COMPLETE SERVICE

When you invest in Allis-Chalmers equipment, you get top performance in *every respect*. Your Allis-Chalmers dealer is fully equipped to serve you completely, conveniently. Make him your single source for:

- **Complete Parts Service**—original-quality parts on hand to meet your requirements quickly.
- **Specialized Service—Shop or Field**—top-notch mechanics are factory-trained to service your needs efficiently in a fully equipped shop or on your job.
- **Ready-to-go Exchange Assemblies**—completely reconditioned assemblies on call. Your trade-in assembly is rebuilt without overtime charges . . . your machine is back to work quickly. Your cost? Only parts and regular-time labor needed to recondition your old assembly.
- **Tailored Financing**—terms suited exactly to the financial requirements of all your machinery needs.

From one convenient source, then, you get the complete service package—job application information, new and used equipment, parts, service and financing. Who could be more interested in backing you up than your dealer? That's his *business!*

Your every transaction in sales, parts, service and financing is fully backed and

ALLIS-CHALMERS

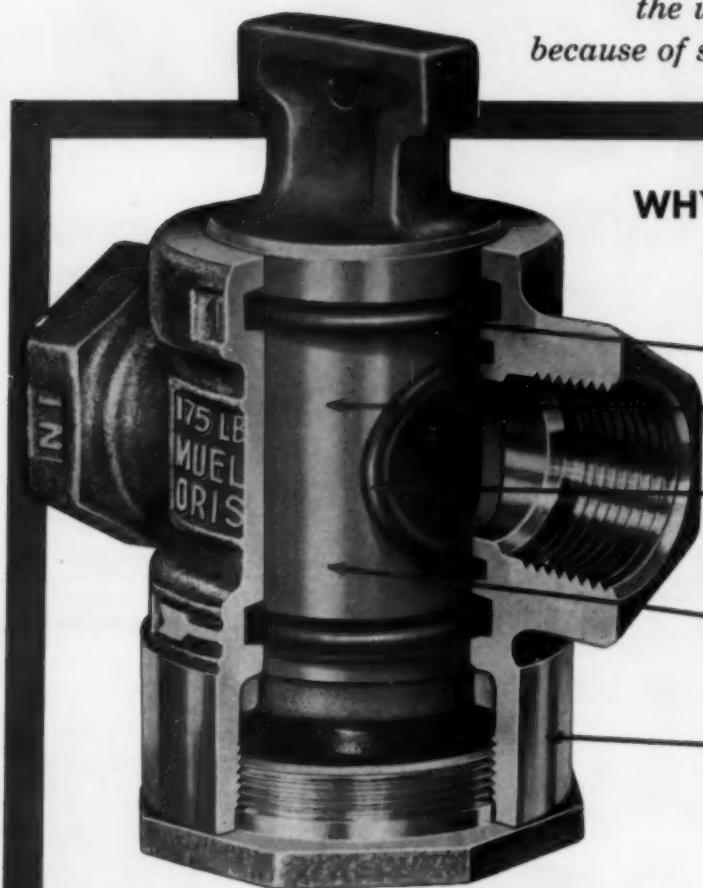
POWER FOR A GROWING WORLD



ORISEAL[®]

by **MUELLER[®]**

*Introduced one year ago . . .
today recognized as the lifetime curb valve by
the water works industry
because of superior features!*



WHY? *Lifetime easy turning
action . . . lifetime positive
sealing action!*

Top and Bottom O-rings—provide positive pressure sealing without mechanical means.

Straight, Balanced Pressure Plug—O-rings of equal size at top and bottom eliminate end thrust, contribute to turning ease.

Port O-ring—in a specially designed groove in the body provides maximum support for O-ring, preventing major cause of damage to O-ring. Seating action gives positive pressure sealing and long life.

"Teflon"^{*} coated Plug—prevents "sticking" or "freezing", even after long periods of idleness. "Teflon", an inert material having a very slick surface, eliminates the necessity of periodic lubrication or maintenance.

Strong Cast Brass Body—of extra strength and with heavy-duty check lugs, enables the Oriseal body to withstand all normal operating and installation stresses.

TEST . . . an Oriseal Curb Valve in your system. Check the positive sealing and easy turning qualities that have made this the *lifetime* curb valve. See your Mueller representative or write for illustrated folder and test report on the Oriseal Curb Valve.



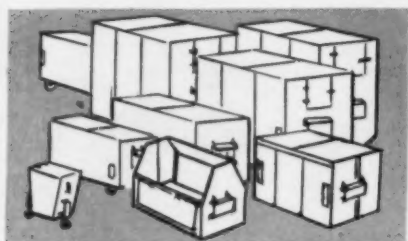
**MUELLER CO.
DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited, Sarnia, Ontario

*Registered trademark of the DuPont Company.

6258

America's Leading Line of Mechanized



DUMPMaster Containers are available with or without casters, ranging from $\frac{1}{2}$ through 8 cu. yd. capacity.



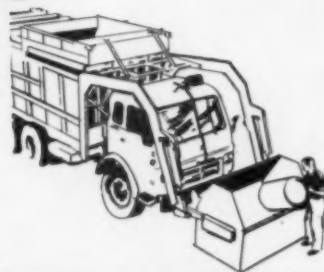
THREE SIZES AVAILABLE

The DUMPMaster is available in three sizes — 20, 24 and 30 cu. yd. bodies. Safe clearance arms that clear the cab doors are available in capacities of 1,500, 3,000 and 6,000 pounds.

This safe, efficient, self-loading packer is equally at home on containerization or manual collection routes.



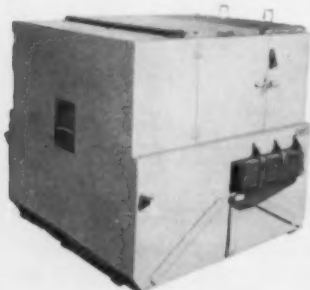
FREE BROCHURE
Catalog Section 10



DUMPMaster
DUMPMaster

The SUPER DUMPMaster-DUMPMaster

The SUPER-DUMPMaster handles converted DUMPMaster Containers up to 12 cu. yds., and all DUMPMaster Containers through 12 cu. yds. Owners of DUMPMaster equipment may secure low-investment conversion kits to adapt their old containers for use with this new system.

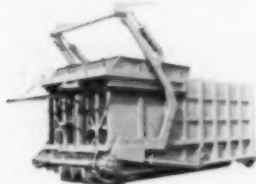


FREE BROCHURE
6073-A

Refuse Storage and Collection Equipment

With its tilting skid frame and hydraulic lifting action, the DINOSAUR handles loads limited only by the capacity of the truck. Containers handled range from 8 cu. yds. to 40 cu. yds. and over. It is ideal for transfer-station use and for handling ash in incinerator operations.

DEMPSTER DINOSAUR®



The DEMPSTER-DINOMASTER used with Dinosaur

FREE BROCHURE
Catalog Section 12



DINOSAUR picks up DINOMASTER body preparatory to leaving on refuse pick-up route.



DINOMASTER engages loaded container and begins emptying cycle.



Dinosaur picks up 40 yd. refuse container



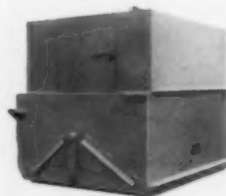
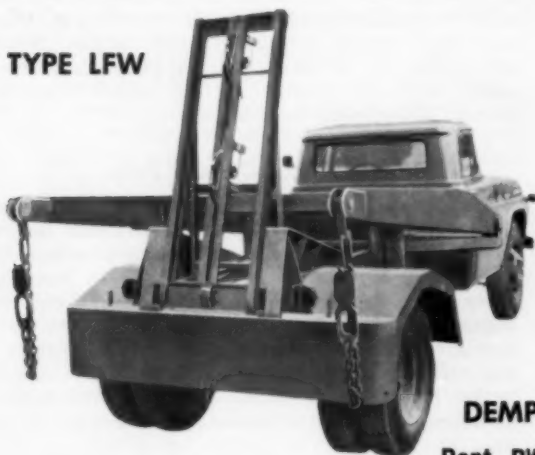
Thirty yard refuse container being loaded by GRD 304-F2

DEMPSTER Compaction TRAILER

This DEMPSTER development is providing highly efficient transfer-station performance in major cities from coast to coast. It can be used with a GRD for ground loading, or ramp-loaded by conventional packers and DEMPSTER-DUMPSTER LFW models. Sizes available are 42 and 53 cu. yd. capacity bodies, which carry the equivalent of up to 200 cu. yds. of uncompacted material on each trip to the disposal area.



TYPE LFW



Still highly popular and efficient for short-haul container service is the DEMPSTER - DUMPSTER Type LFW. One man, the driver, and one DUMPSTER can handle a large number of big-capacity containers each day. Seven basic models are available, with payloads ranging from 6,000 to 38,000 lbs.

DEMPSTER BROTHERS
Inc.
Dept. PW-7, Knoxville 17, Tenn.

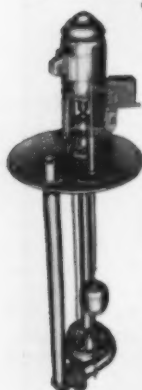
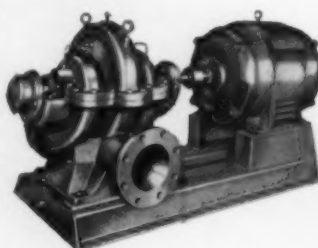
ALL A PART OF THE
DEMPSTER DUMPSTER®
SYSTEMS

for faithful, efficient public service...

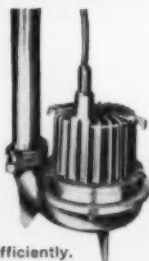
PUT WEINMAN ON THE PAYROLL

More and more, city engineers recognize the real economy of dependable Weinman Pumps for low-cost, trouble-free handling of drainage, water and sewage. With Weinman, revenue goes further towards meeting the ever-increasing demands on municipal water and sewage facilities. And, rugged Weinman Pumps deliver 'round-the-clock service year after year with only routine maintenance.

For instance, city officials rely on Weinman Type L, Single Stage, Double Suction, Split Case Pumps to move water in volume; for high, medium, and low head pumping to 4000 GPM; for 24-hour-a-day service with no down time. Split case design makes routine maintenance fast and easy.



... and, to handle drainage pumping from low to higher level, they look to Weinman's line of Vertical, Submerged, Non-clog Sewage Ejectors. These proven municipal workhorses pump raw sewage and other waste materials without clogging.



... or, for permanent or portable sump installations, the Weinman Type M Non-clog, Immersible Pump handles sewage, industrial wastes and drainage water swiftly and efficiently.

So, for a ready solution to growing water problems, consult your Weinman Specialist. He's listed in the Yellow Pages. Or, write direct for descriptive literature.



THE WEINMAN PUMP MFG. CO.
270 SPRUCE STREET COLUMBUS 18, OHIO
CENTRIFUGAL SPECIALISTS

Ed Cleary reports on:

Stream-flow Forecasts— A New "Tool" for River-Quality Management

EDWARD J. CLEARY

Diplomate, American Academy of Sanitary Engineering
Cincinnati, Ohio

KNOWLEDGE of the availability of dilution water (stream flow) is fundamental to the practice of pollution control. Thanks to the splendid system of stream-gauging long maintained by the U. S. Geological Survey, the sanitary engineer has had access to a wealth of hydrologic data from which to determine the volume and flow-frequency patterns of rivers. This in turn has promoted the application of judgment in designing sewage and industrial waste-treatment facilities.

So far as design needs are concerned, it is sufficient to have an historical record of stream flows. But if we regard pollution-control practice as a dynamic exercise in the management of river quality, the need becomes apparent for daily information—and preferably advance forecasts—on the availability of dilution water.

This need asserts itself particularly in dealing with the control of industrial wastes. Such discharges do not have the relative constancy of volume or composition that characterizes municipal sewage discharges. Therefore, to attain maximum protection for the stream as well as maximum economy in the disposal of waste, the possibilities of "tailoring" discharges to the actual available river dilution command attention.

It is of interest to report, therefore, that some progress has been made in fashioning the "tools" for applying this management concept in the Ohio Valley by enlisting the cooperation of the U. S. Weather Bureau. Here the Cincinnati office is now providing a daily service of predicting volume and velocity of flow three days in advance. This forecast of what is to be thus furnishes a valuable supplement to the Geological Survey's recording of what was. The forecasts may be regarded as the "news" for guiding day-by-day operating decisions as contrasted with the "history" of flow, which is so important in designing facilities.

A Practical Case in Point

Application of this concept of proportioned discharge geared to daily flow was advanced by the writer several years ago in developing proposals for the control of chloride concentrations in the Ohio River. Here the indiscriminate discharge of chloride wastes have on occasion resulted in concentrations during low water that were recorded at 140 ppm in one stretch. However, by proportioning discharges to flow it was calculated that the concentration could be averaged-out not to exceed some 35 ppm at any time.

In order that such a proposal could be practically applied two conditions had to be met: (1) Installa-

tion of storage lagoons at points of chloride discharge; and (2) operation of the lagoons in accordance with a discharge schedule related to river flow. The first condition could be achieved by the adoption of regulations requiring lagoons.

The second condition, however, called for something that did not exist—namely, a means of securing daily information on flow and a system for relaying this information to the lagoon operators.

It was in connection with this second condition that the services of the U. S. Weather Bureau were enlisted. At Cincinnati the Weather Bureau maintains a Flood Forecast Center where techniques have been perfected for the prediction of river-stage information on the Ohio during periods of high water.

Consultation with the meteorologists at Cincinnati and in Washington revealed that it might be possible to extend this service for all periods of the year to provide a daily forecast and to predict flows three days in advance at various points on the Ohio River as well as on some of its tributaries.

Weather Bureau Meets the Need

With the enthusiastic support of Ralph F. Kresge, hydrologic engineer, (Eastern area) of the Weather Bureau, this possibility has now become a reality. During the past two years the Cincinnati office of the bureau has been providing this unique service to the Ohio River Valley Water Sanitation Commission and to other interested parties. The forecasts are made under the direction of Roy M. Lundquist, hydrologist-in-charge. The procedure is based on a daily evaluation of rainfall and prevailing run-off characteristics in various parts of the Valley.

Meantime, regulations have been adopted by the eight states of the Ohio River Valley Water Sanitation Commission pointing to the installation of lagoons for chloride-waste producers. Operation of these lagoons to secure proportioned discharge is now feasible, thanks to this new "tool" that has been fashioned by the River Forecast Center at Cincinnati.

As time goes on and it becomes desirable to extend application of the proportioned-discharge concept, ample experience will have been gained on the use of daily and predicted river flows for quality management. Meanwhile, important benefits are already being derived from a supplementary service associated with the flow forecasts. The Cincinnati office of the Weather Bureau not only predicts volume of flow but likewise furnishes data on velocity of flow at various points along the 981-mile Ohio River.

Velocity-of-Flow Predictions

The velocity-of-flow information ties in directly with a hazard-and-alert system developed by the eight-state sanitation commission and Ohio Valley industries. Under this plan any industry that may have the misfortune of an accidental waste spill in the river immediately notifies its state pollution control agency. In turn this information is relayed to the headquarters office of the interstate commission.

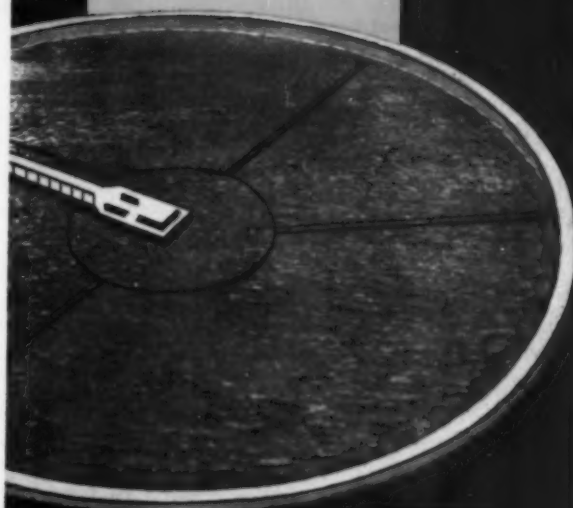
Armed with daily data from the Weather Bureau on both the volume and velocity of river-flow the commission staff can then assess the degree of hazard. This makes it possible to issue an alert to downstream water users regarding concentrations and the anticipated time when a slug of polluted water may reach the vicinity of an intake.

The importance of this system was dramatically

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Solving your iron and manganese removal problem by coagulation in the high pH range is only one of the many reasons you will find Ferri-Floc a superior coagulant. Let one of our experienced technicians demonstrate Ferri-Floc in your plant.

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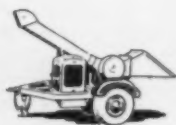


With an ASPLUNDH CHIPPER you can:

- Save 75% of your loading and hauling costs—4 Truckloads of brush equal 1 of chips.
- Reduce disposal time, labor and equipment to an absolute minimum
- Speed clean-up—free men for more trimming time.
- Eliminate burning problems and dump costs.
- Provide income—a ready market exists for chips. Used for mulching, erosion control, walks, etc., and by nurseries, farms and zoos.

No wonder Asplundh Chippers are the fastest-selling, most often specified chipper on the market today. The fact that you can chip *more brush faster at less cost* with an Asplundh Chipper has been *proven* by the largest tree company in the world. It is by far the best chipper you can buy.

Write *today* for full details. Better—ask for a prompt demonstration without obligation.



ASPLUNDH CHIPPER COMPANY
Hamilton St., Chalfont, Pa.

By Actual Test the Fastest Chipper Made

evidenced a few months ago. A broadcasting station in a major city along the river learned of a highway accident in which cans of cyanide rolled from a truck into a tributary creek some 18 miles above the city.

Without checking on all details, the station broadcast that the water supply of the city was about to become poisoned with cyanide. Fortunately, with accurate information on hand regarding river volume and velocity the interstate sanitation commission could quickly provide state and city officials with some facts that ruled out cause for public apprehension.

The facts were these: Dilution provided by Ohio River at the time of the accident would have accommodated some 1,750,000 pounds of cyanide before creating a hazard—the accident resulted in the spillage of less than 1,000 pounds; furthermore the velocity of flow was such that the prism of water in the vicinity of the accident would not have reached the city for some 48 hours.

This new "tool" for improving the management of river quality in the Ohio Valley is one that may be found useful in other areas of intensive water use. At least, it points up possibilities wherein the existing skills and services of the U. S. Weather Bureau may find application in aiding the sanitary engineer in safeguarding water resources.

Engineering Notes

Prevailing Contract Prices

For 1960, the annual report of the Department of Public Service of Duluth, Minn., E. F. Hensch, City Engineer and Director of the Department, lists high, low and prevailing contract prices for various work. The "prevailing" prices are as follows on:

Clearing \$300 per acre; grubbing \$300; 7-in. concrete pavement \$6.00 psy; concrete sawing 25 cents per lf; excavation, trench, 6 ft. deep, \$2.75 per lf; rock excavation in trench \$15 per cy; manhole \$250; manhole below 10-ft. depth, \$40 per ft.; 8-in. vc sewer \$2.75 per lf; 12-in. vc sewer \$4 per lf; 12-in. re. conc. pipe, furnished and installed \$4.25 per lf; 8-in. AC pipe furnished and installed \$2.50 per lf; trees removed, 4 to 12 in., \$15; trees removed 13 to 26-in., \$30; stump removal \$20.

Driving Simulators Can Help in Road Design

The development of a variety of driving simulators to pretest highway designs and traffic control devices is of high priority in the field of highway research. A driving simulator is a device in which a subject, in a full-scale automobile, is subjected to realistic highway and traffic situations, usually projected on a motion picture screen ahead of him. The automobile is arranged to create the impressions of movement, acceleration and braking experienced in a real car, and sounds of the motor and environment are re-created to help make the test driver feel he is actually on the road. According to E. H. Holmes, Assistant Commissioner for Research of the BPR: "With simulators we can control all of the factors in a traffic situation and so determine the real efficiency of design elements and specific traffic systems. In short, driving simulators can tell us things which we might otherwise learn only through such experience as ac-

BYERS GUIDE

Tips on Reducing Corrosion Costs from A. M. Byers Company VOL. 2, NO. 8



MANIFOLD—One of three giant Wrought Iron pump suction manifolds which will serve the new Deer Island Sewage Plant in Boston, Massachusetts.

Giant Wrought Iron Manifolds To Serve 900 MGD Sewage Plant

Boston's Deer Island Sewage Treatment Plant will handle up to 900 mgd of sanitary and industrial waste water and storm water from the Boston area. Sewage reaches the plant through the 10' diameter North Metropolitan Relief Tunnel and the 11' diameter Boston Main Drainage Tunnel. Flow through the tunnels is by gravity, and both run 300' to 350' under Boston Harbor.

Because of the corrosive nature of the wastes, pump suction manifolds are constructed of Byers $\frac{1}{2}$ " Wrought Iron plate. Each manifold is 89'6" long with an 11' inside diameter, and will provide suction for ten variable speed pumps. These manifolds offer continuing in-place resistance to corrosion, and relieve any concern for leakage. At the same time, they serve as forms for the pump suction wells.

The manifolds will be buried in a monolithic concrete structure which also contains the riser shafts from the tunnels. In such a position, resistance to corrosion for the probable life of the plant is of extreme importance. It is in applications such as this that Byers Wrought Iron really pays off.

Wrought Iron is a two-component metal consisting of high purity iron, laced with millions of fibers of glass-like iron silicate. This composition is the secret of Wrought Iron's resistance to corrosion and fatigue. Byers Wrought Iron has earned its reputation for permanence by standing up to conditions that make short work of other metals. Further information on the application of Byers Wrought Iron for sewage plants is yours for the asking—use the coupon.

Wrought Iron Ladder Steps Provide Lowest Cost Per Year Plus Maximum Safety

Although manhole ladder steps are subjected to extremely corrosive atmospheres—there has never been a reported failure of Wrought Iron ladder steps.

The exposed metal surfaces of ladder steps are attacked by condensation and acid-forming gases. Accumulation of corrosion products traps even more moisture and more acids are formed. Corrosion is then accelerated in these localized areas. A weakened ladder step can give way under the weight of a man, precipitating a serious accident.

However, Byers 4-D Wrought Iron is well-known for its ability to take this kind of attack without weakening. When corrosion starts, Wrought Iron's built-in barriers—millions of iron silicate fibers threaded throughout the metal—check its progress. In addition, Wrought Iron forms a dense, adhering oxide protective coating that shields the underlying metal.

Wrought Iron ladder steps assure longer service life and thus provide lower cost per year plus maximum safety. Design and engineering data on this and other applications is available. Use the coupon.



LADDER STEPS—Both of these ladder steps were installed in 1939. After 20 years of service, the Wrought Iron step was still in excellent condition, while the steel step (step proper and 1" of supporting arms shown) is practically gone.

A. M. BYERS COMPANY



PIPE PRODUCTS: Wrought Iron • PVC • Steel
ROLLED PRODUCTS: Plates, Billets and Bars •
Wrought Iron, Stainless and Alloy Steel

A. M. Byers Company, Clark Building, Pittsburgh 22, Pa.

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☐ Sewage Bulletin ☐ Wrought Iron for Manhole Ladder Steps

Name _____ Title _____

Company _____

Address _____

TRAFFIC SAFETY

America's No. 1 Problem...



HELP SOLVE IT WITH



GLASS BEADS

The appalling loss of lives on our streets and highways is one of the great tragedies of our time. Among the several factors affecting highway safety, none is of greater importance than the need for minimizing nighttime accidents. Flex-O-Lite Reflective Beads offer one of the most effective means of reducing the hazards of night driving. Clearer, brighter, longer lasting spheres by Flex-O-Lite are available for every need, including:

- Highway Centerlines and Edgelines.
- Traffic Signs and Markers.
- Safety Spheres for Danger Points where ultra-high brilliance is required.
- Also—Traffic and Sign Bead Dispensers.

Optical quality, medium index of refraction beads also available for colored backgrounds such as: red stop signs, evacuation route markers, street name signs, expressway signs, etc.

FLEX-O-LITE MANUFACTURING CORP.

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Flex-O-Lite of Can., Ltd., P. O. Box 216, St. Thomas, Ont., Can.

cidents and traffic jams. Special simulators for our needs will produce highways that are more efficient as well as safer."

An advanced driving simulator has been developed and is in use by the Institute of Transportation and Traffic Engineering, University of California at Los Angeles. Scientists at Cornell University, working under a grant from the U. S. Public Health Service, have developed a design for a high-fidelity driving simulator in which a subject would drive through traffic complexes transmitted to a screen completely surrounding the automobile from scale models through a closed circuit television system. Mechanical devices simulating vibration, forces of inertia, noise, and other elements a driver would experience on a real highway would create a powerful air of realism.

Cost of Laying Water Mains

Cost data on laying water pipe are included in the 1960 report of the Augusta, Maine, Water District of which S. S. Anthony is superintendent and engineer. For 4,509 ft. of 6-inch cast iron cement lined pipe, the cost was \$3.61 per foot, including \$2.50 for materials, 53 cents for labor and 57 cents for equipment. For 2,249 ft. of 8-inch CIGL pipe, overall cost was \$7.53 per foot, including \$3.50 for material, 97 cents for labor and \$1.15 for equipment, plus some "other charges." For 1,343 ft. of 16-in. CIGL, overall cost was \$12.40 per ft., including \$8.87 for materials, \$1.70 for labor and 94 cents for equipment.

Residential Street Lighting Helps Sell Houses

Prospective home buyers generally have more free time for househunting at night, so a Houston, Texas, development company has turned to a time-tested merchandising technique—illuminated showcases—to attract more after-dark customers. The "showcase" is the Meyerland development of 2500 units, and the illumination is provided by conventional residential street lighting fixtures supplied by the General Electric Company. The Meyerland residential area is illuminated by 364 GE filament luminaires mounted on 20-foot steel poles with four-foot upswing brackets. Each unit produces 2500 lumens of light. The average maintained illumination level is 0.2 footcandle.

Cost of Refuse Collection and Disposal

The total cost for collection and disposal of combustible refuse in Kenosha, Wisc., during 1960 was \$20.20 per ton for 10,641 tons of material. This cost included collection, labor, gas, oil, equipment and repair costs and incineration. For collection and disposal of 10,908 tons of non-combustible refuse the cost was \$12.53 per ton, including dump maintenance. Cubic yardage was 46,318. Non-combustible weight decreased 91 tons from the preceding year but the volume increased 8,842 cu. yds., reflecting changes in the type of refuse.

Refuse and Garbage Collection in Detroit

During the 1959-60 fiscal year, Detroit collected 3,174,276 cubic yards of refuse. Both incineration and landfill methods were used for disposal. The cost for collection and disposal was \$3.75 per cubic yard or \$7.13 per capita. In addition, 367,019 tons of garbage were collected and incinerated at a cost of \$15.36 per ton or \$3.37 per capita.

NOW-GPX® ACRYLIC OVERLAID

Conforms to Commercial Standard CS 45-60

WHITE-GREEN BLUE-RED

Colors conform to Am. Assn. of State Highway Officials' Manual

4 new permanent colors in GPX plywood

- GPX is now available with acrylic overlay ... in permanent colors of green, white, blue or red. Order it in any combination of colors front and back, or with natural or black high density one side.

- Resists severe weather and abuse. Won't rust or corrode. Can be fabricated with wood-working tools. GPX costs less, lasts longer

than metal. Reflective sheeting bonds better to overlaid plywood surface.

- Strong, stiff panels light, easy to handle. Require minimum backing and framing.

- 1-piece panels up to 60" x 120", larger scarfed panels also available.

- Write today for free sample, complete data.



GEORGIA-PACIFIC

Dept. PW-761, Equitable Building, Portland, Oregon • plywood • lumber • redwood • hardwood • pulp • paper • chemicals

Seven years of field experience prove it! **YOU CAN MAKE**



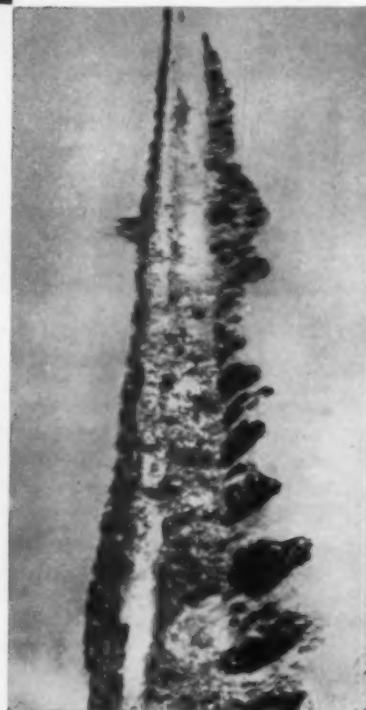
BROKEN ABUTMENTS: Restored stronger than new by brushing on polysulfide-epoxy adhesive to rejoin old concrete, or to bond fresh concrete to old.

FASTENING TRAFFIC MARKERS. Fixed to road surface with polysulfide epoxy adhesive alone, lane strips have stayed rigidly in place for long periods of time.



FILLING RUTS AND DIPS. Adhesive and aggregate mixed in ratio of 1 to 5 is spread and troweled right over depressed area. No digging down to roadbed or exposing steel reinforcements.

SPALLED JOINTS: Repaired in two hours by using polysulfide-epoxy mixed with aggregate as trowelable compound. Reduces tie-up time as much as 48 hours.



LITTLE OF BIG REPAIRS



...with concrete adhesive based on THIOKOL liquid polysulfide polymer

Two chemicals in combination, THIOKOL liquid polysulfide polymer and epoxy resin, are providing one of the most useful engineering tools of our time.

Together, they produce a brushable, quick-cure adhesive used to join old or fresh concrete to old...to bond skid-proofing materials to roadways...to seal and protect surfaces against chemical attack and water seepage. The resultant bond is stronger than concrete itself, waterproof, acid resistant, and flexible enough to withstand repeated freeze-thaw cycles.

Repairs which heretofore required days of labor and road down-time, the use of heavy equipment and large crews of men are now being completed at a fraction of the cost in time, manpower, material and dollars. Serviceability of such repairs is, by actual experience, proving more satisfactory than those achieved by conventional methods.

Want to know more about this new engineering material? How it's used? Where it's used? The benefits and economies that accrue? Write to Thiokol for brochure CA-200.



POT HOLES: Repaired to featheredge and ready for traffic in as little as three hours when patched with mortar mix of polysulfide-epoxy, sand or aggregate.



HAIRLINE CRACKS: Filled with polysulfide-epoxy. Adhesive film sprayed or brushed over surface seals out water, checks further deterioration.

SCALED AREAS: Repaired in only a few hours with adhesive containing THIOKOL liquid polysulfide polymer. Bonds new concrete to old. Watertight bond stronger than concrete itself.



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Gentlemen: Please send me your Brochure
CA-200 dealing with concrete adhesives
applications and methods.

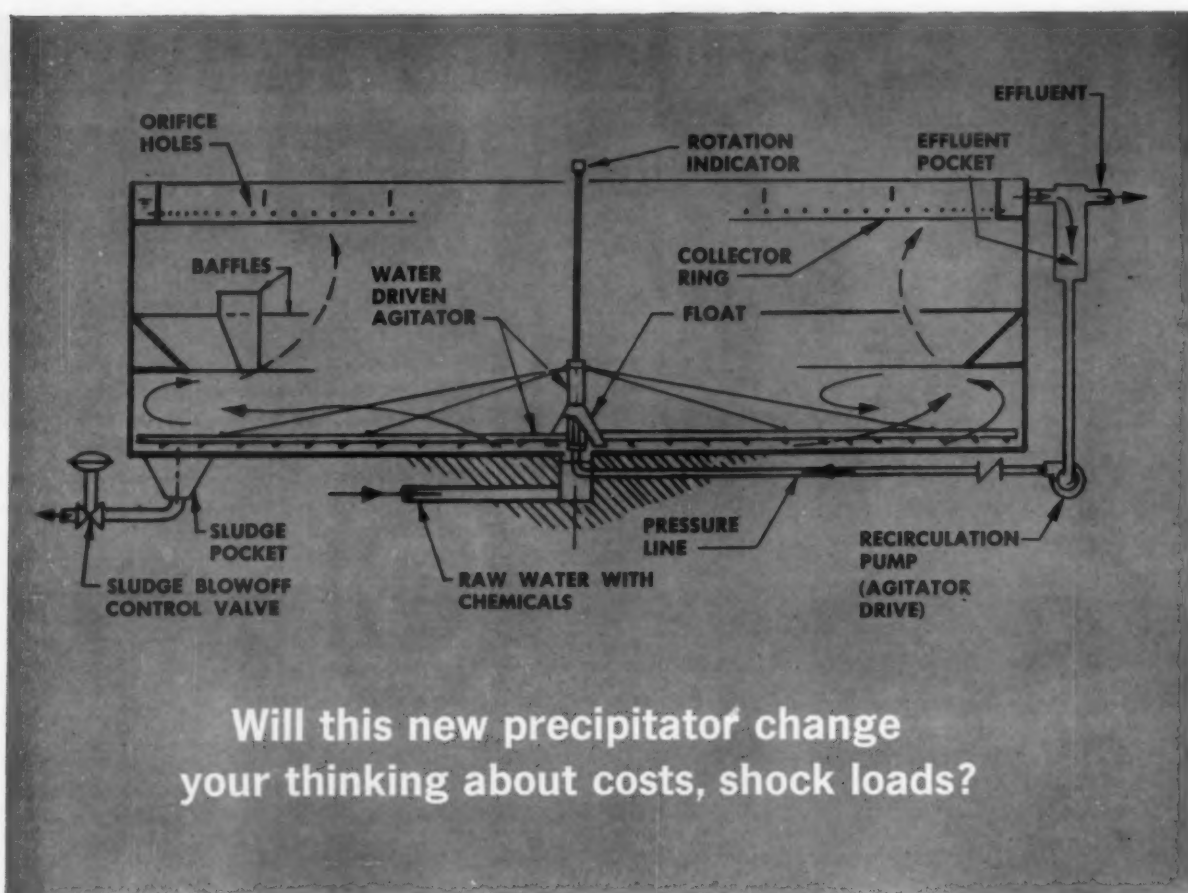
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Will this new precipitator change
your thinking about costs, shock loads?

New Permutit Type M Precipitator ... a study in simplicity

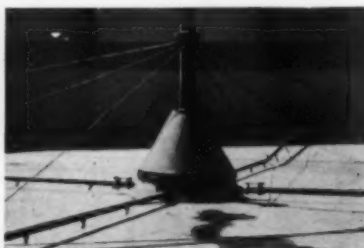
Now in operation is this new precipitator for reducing turbidity and color in water.

We call it the Permutit Type M Precipitator. It is a study in simplicity, and because of its low construction and operating costs, it opens up new opportunities to obtain solids-contact clarification at minimum cost.

"Missing" parts: There is no motor-driven agitator on the Permutit Type M Precipitator. No extensive baffling. No center platform. No access walkway. All these have been done away with, because the unit has a new and different agitator system which sweeps away the settled sludge. Rotating agitator arms are supported by a "semi-buoyant" hub (or float) which revolves about a bearing post on the tank floor. Recycled effluent drives the agitator through jet nozzles located at the end

of each arm. Smaller jets, spaced along the arms, gently nudge the settled sludge toward a sump at the outer rim of the tank floor.

Briefly, this is how the M unit works: raw water and chemicals are mixed in line and enter at the center of the tank floor beneath the conical rotor float which deflects the fluid mixture radially outward to the walls. A horizontal baffle on the tank wall then reverses the flow back toward the center thus imparting a rolling action to the sludge blanket. This current flow constantly



Agitator float and hub assembly.

places previously formed sludge in intimate mixture with the raw water immediately as it enters the tank. Clarified, effluent is collected by a flume at the top.

Sudden water changes: An additional benefit of the Permutit Type M Precipitator is its exceptional ability to handle shock loads.

A case in point: red dye from a paper mill a mile upstream showed up one day in the raw water entering a Permutit Type M Precipitator in use in New England. But the unit went right on putting out an effluent with no significant change in quality.

So much interest has been shown in this new unit that we have reprinted the paper, "A Recent Development in Solids Contact Clarification Design", by E. D. Driscoll of Permutit. We'll be glad to send you a copy.

Write to Permutit Division, Dept. PW-71, 50 West 44th St., New York 36, New York. (In Canada, contact the Permutit Company of Canada, Toronto.)



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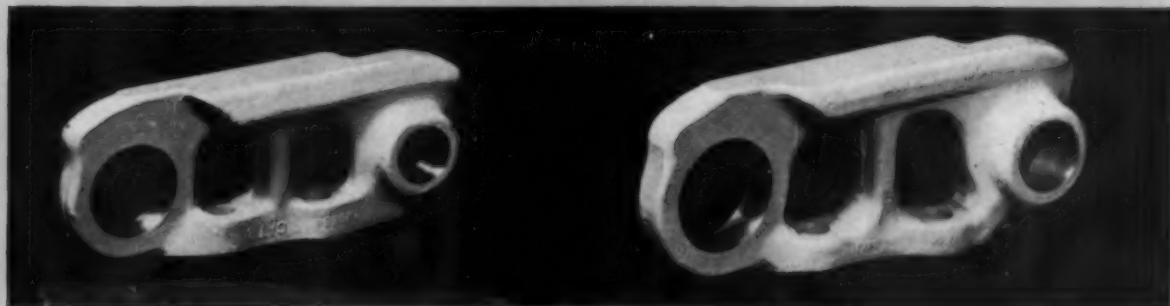
Special report to users of Cat D6 and D7 track parts



Up to 25% Longer Link Life at No Increase in Cost

New track links have rails hardened deeper than any other brand . . . hardness with file-like, wear-resistant qualities

You can't "see" metallurgy and heat treatment in track links. But you'll definitely see the *results* in the extra life you get from the *new* Cat D6 and D7 track links. These superior links will outlast all other brands yet the suggested price is no higher than before.



D6, 955 AND 561 LINKS

- "Hi-Electro" hardened rails give outstanding wear life.
- Rail wear cases are twice as deep as other brands.
- Closer bore tolerances retain pins and bushings better.
- Full 1 1/4" top rail surface to pin boss clearance allows more wear before roller flange contact.

D7, 977 AND 572 LINKS

- 12% thicker rails eliminate peening, rebuilding distortion.
- 32% thicker struts and more steel in critical areas increase over-all strength, resist cracking.
- File-hard "Hi-Electro" hardened rails withstand abrasive wear.
- Uniform, wear-resistant rail cases deeper than other makes.

These new track links are made from special steel, carefully pretested *before* manufacture. They're forged, machined and heat treated to develop maximum strength and toughness. A non-peenable wear barrier is induced *deeply* into rail top and sides by exclusive "Hi-Electro" hardening. This exacting heat treatment permits maximum, file-like wear resistance without brittleness.

Try the new links . . . and the many other *special-purpose* tractor undercarriage parts, all designed and built to keep your cost-per-hour to a minimum. Cat undercarriage specialists can help you select right combinations and give you money-saving recommendations tailored to your particular needs. It's all a part of your Dealer's Custom Track Service . . . the practical approach to lowering undercarriage costs by extending part life and machine availability through proper parts selection and parts care.

Etched rail cross-section shows deep, uniform wear case found on top and sides of new links.



CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Caterpillar Tractor Co., General Offices,
Peoria, Illinois, U. S. A.

POKER? Play to win!



How would you play this hand?

Raise? If your 3-of-kind are nines or lower, yes. Four times in five your hand will be high before the draw, but protect it. If the 3-of-kind are tens or better, don't raise until after the draw. You want customers.

Here's a sure winner from FORD:

Sherman C-8 Bobcat power digger—master of the bell hole.

From one quick-set tractor position, the Bobcat digs clean, straight-sided bell holes faster and cheaper than any other unit on the market. Close-coupled to tractor, excellent for work in close quarters.

The Bobcat's a master of the small hole, too. Digs 5 feet deep with a surface opening as small as 48" in length. Get all the details from your Ford Tractor Dealer, or write:

Tractor and Implement Division
Ford Motor Company
Birmingham, Michigan



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

City Hospital

City of Detroit v. Eisele, 108 N.W. 2d 763, a Michigan case decided April 26, 1961, was an action by the city to recover for hospital services furnished to defendant after she was injured in an automobile accident. Defendant was hospitalized at the Detroit Receiving Hospital for injuries sustained in an automobile accident. At the time she was an unemployed married woman, with two children, whose only means of support was her husband's earnings.

Plaintiff, city of Detroit, commenced suit against defendant for the balance due on the hospital bill in the amount of \$5,905.70. Defendant's husband's Blue Cross insurance had paid approximately \$7,000 toward the bill. In its declaration plaintiff alleged the hospital and medical services were rendered at the request of defendant and her husband and that she expressly or impliedly promised to pay.

Defendant filed her answer denying she had requested the services or that she had promised to pay for them, either expressly or impliedly. She contended that if any credit was extended, it was not to her, but to her husband, who was under a duty to provide her with such services.

The court held that plaintiff had failed to make out a cause of action against the defendant wife.

Condemnation of Land for a Highway

In re Mackie's Petition, 108 N. W. 2d 755, a Michigan case decided April 26, 1961, was a procedure by the State Highway Commission for condemnation of certain private property for highway purposes.

The controversy concerned its value, as affected by zoning restric-

tions. The appraisers for the state based their appraisal on the value of the property for residential purposes, since the property was zoned for residential use only. On the other hand, the appraiser for the owner based his valuation in part on its use as a commercially-zoned property, on the possibility that it might be re-zoned.

An application for re-zoning had been made half a year prior to the beginning of the condemnation proceedings. The petition requesting re-zoning had been deferred until a study of the possibility of widening the street and using it for commercial purposes could be made.

The court held that the possibility of such re-zoning was neither frivolous nor purely speculative, but was a reasonable possibility, and that this possibility should be assigned a monetary value in fixing the value of the property at the time of its condemnation.

Loss of Access to Highway

Darnall v. State, 108 N.W. 2d 201, a South Dakota case decided March 3, 1961, was an action for claimed loss of access to an interstate highway. Plaintiffs are the owners of three lots on the edge of the village of Piedmont with 150 feet of frontage on the west side of First Street; on these were a small cafe, a two-unit and a four-unit cabin and a gas pump. The street was 80 feet in width and designated as U. S. Highway 14 and State Highway 79. It had a blacktop surface of standard width with two lanes of travel from which motorists could drive into plaintiff's property. Most of plaintiff's business came from tourists in summer and some truckers during the year. In 1958 the state took proceedings to construct Interstate Highway No. 90 in that vicinity as a controlled-access highway with two separated roads of two lanes

- NOW you can get**
- 1 COMPLETE SEWER ODOR CONTROL**
 - 2 FREE APPLICATION EQUIPMENT**
- with**

ZEP-O-BAN

heavy duty deodorant

Odor control in your city's sewage system no longer will be a problem . . . or major expense . . . with Zep-O-Ban. The value of this emulsifiable chlorobenzene in odor suppression is well-established. Its stable, concentrated liquid form permits use in solutions diluted enough to make yearly cost low, yet strong enough for positive, three-way odor control. It effectively masks existing odors . . . prevents others by destroying sulphide-producing micro-organisms . . . controls growth of fungi which speed waste decomposition. Normal treatment consists of one to five parts Zep-O-Ban for each million parts sewage or industrial waste as it enters collection system. This chlorobenzene/sewage ratio does not affect natural anaerobic processes or efficiency of activated sludge.



FREE ZEP-O-BAN DISPENSER regulates deodorant flow automatically

Initial setting of float and metering valve—to suit sewage flow of your installation—makes unit automatic . . . no constant checking . . . no valve adjustments because of irregular flow . . . ideal for unattended lift stations, disposal plants. Regulates flow accurately . . . from as low as 5 drops per minute!



For further information about Zep-O-Ban and how you can get a free dispenser, call or wire collect our office nearest you.

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FIRST in Maintenance and Sanitation

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Increase roadway and runway safety with Transite Underdrain Pipe

Eliminate the contributing causes of sags, holes and similar hazards to under-wheel safety with perforated Transite® Underdrain Pipe. Its superior performance in groundwater control has been proved in many county, state and federal installations.

Transite Underdrain has an exceptional weight-to-strength ratio. The coupling, used to form the joints, assures a flexible yet reliably joined system. This, combined with long (10' and 13') lengths, keeps the pipe aligned and allows the line to ride with normal soil movement without disturbance to the system. Transite's smooth inner surface and low coefficient of friction assist the flow of water and reduce the opportunity for water-borne silt to build up on the invert. Thus, the accurately sized, drilled and located perforations can perform their function of letting groundwater into the line at a maximum flow rate.

For full details, send for data sheet TR-246. Write to Johns-Manville, Box 14, PW-7, New York 16, N. Y. In Canada: Port Credit, Ontario. Cable address: Johnmanvil.



JOHNS-MANVILLE



PUBLIC WORKS for July, 1961

each. In this construction the black-top surface of Highways 14 and 79 was not changed, except to remove the old surface and replace it with a new blacktop surface at the same level and width; neither was any change made which in any way interfered with or limited the access of plaintiffs to Highways 14 and 79 or persons using it. The construction of which plaintiffs complain is that a concrete curb and gutter was installed on the east side of this two-lane blacktop surface, which separated Highways 14 and 79 from the new Interstate. This curb and another about two feet farther east enclose a blacktopped walkway; they prevent traffic on 14 and 79 from entering the Interstate and prevent traffic on the Interstate from entering 14 and 79, except at two interchanges nearly a mile north and south of plaintiff's property. At trial, plaintiffs recovered a judgment for \$7,000 based on this claimed loss of access to the interstate highway.

The court held that this circuity of travel was not a compensable damage. It is a burden shared by all the traveling public. The construction of a highway past a place of business gives owners no vested right to insist that it remain there as a changeless road in a changing world.

• • •

Waste Treatment at Pulp, Paper and Paperboard Mills

According to preliminary data accumulated through the Industrial Water Use Survey, being conducted by the National Council for stream improvement in cooperation with the National Association of Manufacturers, 67 percent of all pulp, paper and paperboard mills have waste treatment facilities. This compares with 39 percent according to NAM in 1950. Also, according to the current survey, water intake by the pulp, paper and paperboard industry currently amounts to 4,980,000,000 gallons daily. Discharge amounts to 4,800,000,000 gallons daily with actual consumption amounting to 180,000,000 gallons daily, or slightly over 3 percent of intake.

Water recirculation makes the intake of 4,980,000,000 gallons do the work of 12,780,000,000 gallons that would be required if no recirculation was practiced. Also, according to the survey, water use, exclusive of cooling water, amounts to 33,700 gallons per ton of average production.

PUBLIC WORKS for July, 1961

CLEAN LINES... Clear Profit!



CLEAN LINES ABOVE!—With its low profile, and front and rear equipment mounted close, this Allis-Chalmers unit is integrated to give you bonus capacity for dozens of jobs. Operators work confidently—sure of their equipment—able to see the whole operation easily.

CLEAN LINES BELOW!—With axles, transmission case, pan and power steering rams compactly organized, the unit works over rocks and dirt with little chance of "hanging up." Operators move free and easy all over the job site.

IT DOESN'T COST TO FIND OUT how Allis-Chalmers *clean lines* lead to *clear profit!* Get the facts from your dealer now or write Allis-Chalmers Mfg. Co., Utility Tractors and Equipment, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS





TRACK-TYPE TRACTOR

DES MOINES, IOWA

OLD PRO

That truck engine on the opposite page is one of Chevrolet's famous Thriftmaster 6's—and if it looks a bit battle-scarred, there's a good reason! This one has just turned 230,000 miles, working for Earl McDaniel of Dallas Texas, on a hustling round-the-clock air mail delivery job. *And here's the stopper: this engine has never been overhauled. It has required only routine maintenance over all those miles.* That, you'll agree, is professional truck power at its dollar-saving best. That's the way it is with the most widely used engine in the business—Chevy's Thriftmaster 6!

Rarely does any truck engine—even a Chevy Thriftmaster 6—run up a performance record like this one. We point it out here merely as proof that the Thriftmaster 6 brings *staying power to spare* to any job it tackles. It's evidence that Chevrolet puts real truck "horses" under the hood—in a light-duty power plant that's built to outlast and outsave any other you can name.



Hustling air mail from airports to town on a stop-watch schedule is a 24 hours a day, 7 days a week responsibility Earl McDaniel, U.S. Mail Contractor, shares with his '59 Chevy 1/2-ton panel. And, according to Mr. McDaniel, after 230,000 miles, the truck "still purrs like a kitten . . . hasn't had or needed an engine overhaul. The pan has never been off, the valves have never needed grinding."

The Thriftmaster 6 provides the basic power for Chevy's conventional light-duty truck line. *Standard* in pickups, panels, light-duty stakes, delivery vans and the Suburban Carryall, it's the end product of many years of engineering refinement.

It provides economy-contoured camshaft and improved carburetion to give you extra power, extra miles from every gallon of gas. Also, there's a forged steel crankshaft, high quality steel and steel alloy valves, durable precision bearings, full pressure lubrication system, oil-bath air cleaner—all contributing to longer engine life and greater overall economy. This is the most experienced truck engine in the business, and it's ready to wade into your roughest work and keep you way ahead on fuel and maintenance expense. It'll pay you to check into it at your Chevrolet dealer's! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

THRIFTMASTER 6 PERFORMANCE DATA

Gross Horsepower.....	135 @ 4000 rpm
Net Horsepower.....	115 @ 3600 rpm
Gross Torque, lb.-ft.....	217 @ 2000 rpm
Net Torque, lb.-ft.....	195 @ 2000 rpm
Piston Displacement.....	235.5 cubic inches
Bore and Stroke.....	3 ¹¹ / ₁₆ " x 3 ¹ / ₁₆ "
Compression Ratio.....	8.25 to 1

1961 CHEVROLET STURDI-BILT TRUCKS

CHEVROLET



TRACK-TYPE TRACTOR

DES MOINES, IOWA

The Des Moines Division of Public Works' new D6B works on gravel pit excavation, street construction and maintenance, and sanitary landfill—jobs that call for power and speed from a medium-sized crawler tractor. Heavy Equipment Supervisor John Porter, a 20-year veteran of Des Moines Public Works, says, "We recommended the Division buy a D6 because of two main reasons: we needed that size machine for its mobility, and we needed the dependability we always get from Caterpillar."

HOW TWO COMMUNITIES CUT COSTS WITH NEW CAT-BUILT MACHINES

GLENVILLE, N. Y.

The town of Glenville, New York, solved its nagging garbage and trash disposal problem with efficient, economical sanitary landfill. The town's 944 Traxcavator spreads, compacts and covers the refuse. Mr. L. O. Dunn, Town Councilman, states, "Economy and long life of our other Cat equipment were big factors in the selection of this machine. It has proved to be good for this job—and a versatile all-around loader in a one-man operation."



WHEEL-TYPE LOADER

Your community or county, too, can save time and money with modern earthmoving or material handling equipment—and savings are even greater if it is Caterpillar-built. Tracks or wheels, important advances in power and operating ease team with traditional Caterpillar reliability and minimum maintenance requirements to squeeze extra work from your tax dollars. Consider, for example, advantages offered by the two machines shown here:

93 HP D6B Track-type Tractor 25% more lugging ability than former model. Adjustment-free fuel system permits use of economy-type, high-energy fuels. Dry-type air cleaner takes only five minutes to service. Forward-reverse lever saves time and effort in dozing and landfill work. Lifetime lubricated track rollers *never* need attention until rebuilding. Exclusive oil clutch delivers up to 2000 hours adjustment-free service. New hydraulic system (optional) with under-the-hood mounting of pump and tank frees front and rear of tractor for attachments, provides up to three hydraulic circuits. Matched tools for many jobs.

105 HP 944 Wheel-type Traxcavator More than seven years of testing have gone into this new excavator-loader. Choice of diesel or gasoline engine. Clean

design for safe, convenient operation. Power Shift Transmission for fast response to load change. 41° bucket break out for heaped loads, stable design for smooth, safe operation, extra bucket reach to place loads fast, easily. Unit construction for easy servicing. Special attachments, buckets, including side dump, tailor machine to job. Roomy cab (optional) with large windows helps keep operator efficiency high. Two other sizes are available: 922—80 HP and 966—140 HP (only flywheel horsepowers listed).

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

Does your community have a refuse disposal problem? One answer is found in the new sanitary landfill movie, "A Decent Burial." It's informative, entertaining... ready to be presented by your Caterpillar Dealer. Call him today.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

**DEPENDABLE MACHINES
GET THE JOBS DONE FIRST**

UNUSUAL STORMS TAX DRAINAGE FACILITIES

ALFRED R. PAGAN

Hydraulic Engineer,
Bergen County,
Hackensack, New Jersey

ASSURING the adequacy of structures affecting drainage is one of the responsibilities of the county engineer's office. In fast growing Bergen County, N. J. with a population of nearly 800,000, a hydraulic engineer is employed to gather data and to report on all problems relating to storm water runoff. The duties include making recommendations as to the capabilities of existing structures such as bridge openings, culverts and storm sewers. Such information is reported periodically to Roscoe P. McClave, County Engineer, and subsequently to the Board of Freeholders for study and action. This might involve allocating funds in the county budget or calling for a bond issue if the case warrants.

An associated duty of the hydraulic engineer is investigation of re-

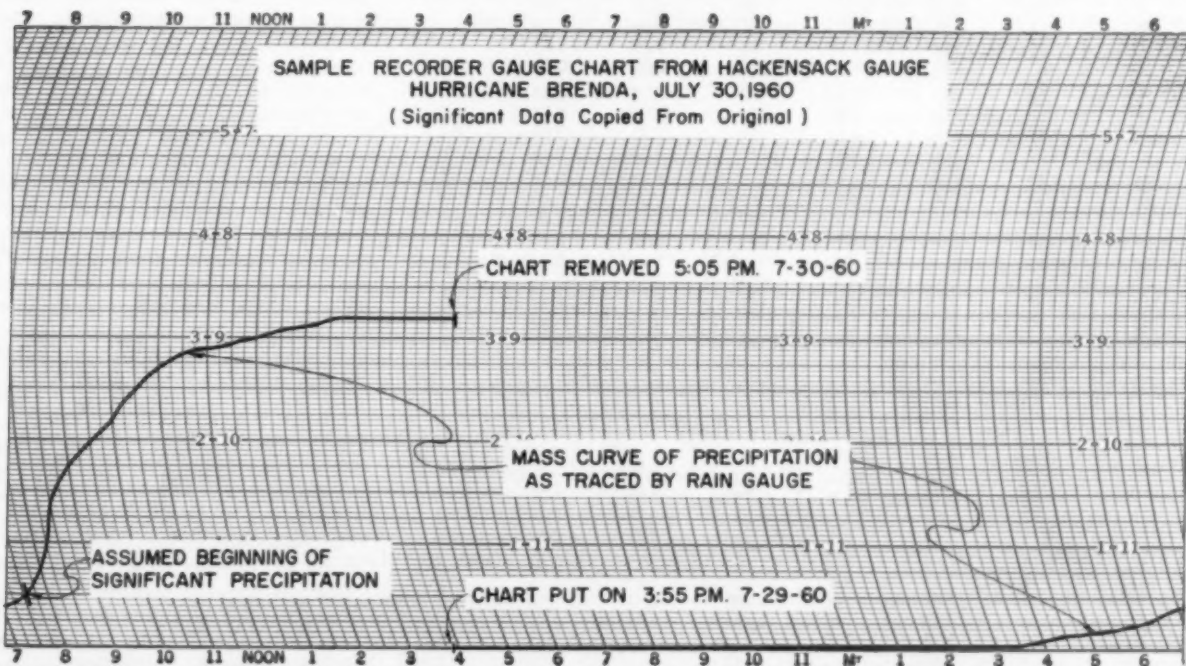
quests, inquiries and complaints pertaining to drainage. Ordinarily the rate at which requests are received, particularly from the 70 municipalities in the county, is quite uniform with little slack or backlogging taking place. However, in the early fall of 1960 the number of communications received was unseemly. The various municipalities, and citizens as well, began complaining of the inadequacies of private, municipal, county and state drainage facilities. Further, the telephone seemed to ring regularly at the behest of mayors, councilmen, borough clerks and town engineers.

What caused this sudden spurt in problems; could it be that many changes had recently occurred in the various watersheds? Were so many new inadequate appurtenances being built that a noticeable in-

crease in flooding resulted? Did this mean that a great number of existing facilities were undersized? None of these seemed to offer a reasonable explanation.

The previous summer (1960) had brought an inordinate number of unusually heavy rainstorms. These ran the gamut from brief showers of several minutes duration to long heavy downpours resulting from hurricanes. There is a natural reluctance to fault existing appurtenances, certainly understandable when the cost of replacement is considered. It was accordingly felt that a study of the precipitation pattern might be of value in determining whether the summer had been truly extraordinary as far as rainfall was concerned.

Fortunately the basic data in the form of actual charts from a record-



● RAINFALL record of Hurricane Brenda, July 30, 1960. Over a 10-hour period total rainfall amounted to about 3 inches.

Table 1—Rainfall in Inches per Hour
(Tabulated from Rainfall Intensity-Duration Curves,
New Jersey Division of Water Policy and Supply)

Duration, minutes	Return Period in Years									
	1	2	3	4	5	6	7	8	9	10
5	4.00	4.50	4.95	5.35	5.70	6.00	6.20	6.38	6.55	6.70
6	3.70	4.25	4.70	5.05	5.35	5.60	5.80	5.95	6.10	6.25
7	3.43	3.96	4.40	4.75	5.06	5.30	5.48	5.64	5.78	5.90
8	3.24	3.75	4.20	4.56	4.82	5.04	5.22	5.38	5.51	5.62
9	3.06	3.57	3.98	4.34	4.60	4.81	4.97	5.13	5.26	5.37
10	2.90	3.40	3.80	4.15	4.40	4.60	4.75	4.90	5.05	5.15
15	2.35	2.80	3.15	3.45	3.70	3.85	4.00	4.10	4.20	4.30
20	2.03	2.45	2.78	3.02	3.20	3.38	3.50	3.60	3.68	3.75
25	1.79	2.18	2.50	2.72	2.89	3.02	3.11	3.19	3.26	3.32
30	1.62	1.97	2.26	2.46	2.62	2.74	2.84	2.92	2.99	3.05
35	1.49	1.82	2.09	2.27	2.42	2.53	2.62	2.69	2.75	2.80
40	1.36	1.65	1.88	2.08	2.25	2.35	2.43	2.50	2.56	2.60
45	1.27	1.54	1.75	1.94	2.09	2.20	2.27	2.33	2.38	2.42
50	1.18	1.44	1.64	1.82	1.97	2.07	2.15	2.20	2.25	2.29
55	1.11	1.36	1.56	1.73	1.86	1.94	2.00	2.06	2.11	2.15
60	1.05	1.30	1.50	1.65	1.77	1.86	1.93	1.98	2.02	2.05
70	0.96	1.18	1.34	1.48	1.60	1.66	1.72	1.77	1.82	1.87
80	0.87	1.07	1.23	1.36	1.47	1.53	1.58	1.63	1.67	1.71
90	0.81	0.99	1.13	1.26	1.37	1.44	1.49	1.54	1.57	1.59
120	0.67	0.82	0.94	1.05	1.13	1.18	1.22	1.25	1.28	1.31
150	0.57	0.70	0.81	0.90	0.97	1.01	1.04	1.07	1.10	1.12
180	0.50	0.62	0.73	0.80	0.86	0.89	0.92	0.95	0.97	0.99
210	0.45	0.55	0.63	0.70	0.76	0.79	0.82	0.84	0.86	0.88
240	0.41	0.51	0.59	0.65	0.69	0.72	0.74	0.76	0.78	0.80
270	0.37	0.46	0.53	0.59	0.64	0.66	0.68	0.70	0.72	0.74
300	0.34	0.42	0.49	0.55	0.59	0.61	0.63	0.65	0.67	0.68
330	0.32	0.40	0.46	0.51	0.55	0.57	0.59	0.61	0.63	0.64
360	0.30	0.37	0.43	0.47	0.51	0.53	0.55	0.57	0.59	0.60

Table 2—Determination of Storm Frequency

Storm of July 3, 1960				Storm of July 30, 1960			
Duration, min.	Rainfall, in.	Intensity, in./per/hr.	Return Period, yrs.	Duration, min.	Rainfall, in.	Intensity, in./per/hr.	Return Period, yrs.
5	0.31	3.72	...	30	0.35	0.70	...
10	0.54	3.24	1.7	60	0.90	0.90	...
15	0.76	3.04	2.7	90	1.25	0.83	1.1
20	0.93	2.79	3.0	120	1.50	0.75	1.5
25	1.09	2.62	3.6	150	1.70	0.68	1.9
30	1.30	2.60	4.9	180	2.00	0.67	2.5
35	1.33	2.28	4.1	210	2.25	0.64	3.1
40	1.37	2.06	3.9	240	2.33	0.58	3.0
45	1.42	1.89	3.7	270	2.40	0.53	3.0
50	1.49	1.79	3.8	300	2.45	0.49	3.0
55	1.56	1.70	3.8	330	2.51	0.46	3.0
60	1.64	1.64	3.9	360	2.59	0.43	3.0
70	1.65	1.41	3.5	390	2.60	0.40	3.0
80	1.66	1.25	3.2	420	2.70	0.39	3.0
120	1.67	0.84	2.2	480	2.70	0.34	2.7
150	1.67	0.67	1.8	510	2.70	0.32	2.6
180	1.67	0.56	1.5	540	2.70	0.30	2.5

Storm of August 10, 1960				Storm of August 15, 1960			
Duration, min.	Rainfall, in.	Intensity, in./per/hr.	Return Period, yrs.	Duration, min.	Rainfall, in.	Intensity, in./per/hr.	Return Period, yrs.
5	0.54	6.48	8.6	5	0.25	3.00	...
6	0.62	6.20	9.7	10	0.40	2.40	...
7	0.67	5.75	8.8	15	0.55	2.20	...
8	0.72	5.40	8.2	20	0.75	2.25	1.4
9	0.74	4.93	6.8	25	0.91	2.18	2.0
10	0.74	4.44	5.2	30	0.91	1.82	1.6
12	0.74	3.70	3.8	35	0.91	1.56	1.2
15	0.74	2.96	2.5	40	0.91	1.36	1.0
20	0.74	2.22	1.4	45	0.91	1.21	...
25	0.74	1.78	1.0				
30	0.74	1.48	...				

ing rain gage were available for study in detail. The county maintains a Bendix-Friez dual traverse type recording gage (see photograph) which measures the catch by weighing the amount of precipitation falling into an ordinary household pail through a standard 8-in. opening. The weight of the water is automatically translated into inches of rainfall and recorded on a clock-operated rotating drum. The gage is located in Hackensack, N. J. near the Hackensack River and is not far from the center of population of the county. The U. S. Weather Bureau makes semi-annual inspections of the gage and keeps the mechanism in proper adjustment.

It was decided to explore in detail the records for the period July and August 1960, since most of the complaints referred to this span of time. The charts were all examined to find all storms having any possibility of a return period of two years or more. Promising storms were used in conjunction with rainfall-intensity-duration curves (Table 1) slightly modified from those developed by the N. J. Division of Water Policy, Department of Conservation and Economics. These curves had been derived from precipitation data as recorded during the period 1893 to 1939 at five rainfall stations in northern and central New Jersey. Using the information gleaned from the recorder charts it was possible to pick out the expected return period for each of the significant storms. In order to arrive at the frequency when the data lay between two curves it was possible to interpolate from the curve on either side of the particular storm event. Table 2 summarizes the findings of the study. It is seen that the rarest storm occurred on August 10, 1960 and had a return period of almost ten years. This is certainly ample to cause significant flooding, particularly in areas which are inundated even during lesser storms. Four storms during the two-month period exceeded the arbitrarily selected two-year storm. Particularly significant is the fact that these events covered durations from less than five minutes to more than ten hours. Such a range indicates that even the larger streams of the county had time to reach relatively high stages. Further, some durations were represented two or three times. The worst storms were those of rather short periods and this agrees with the pattern of complaints received which generally involved basins with areas of under 100 acres.



Courtesy Howard Wehner

● BENDIX-FRIEZ recording rain gauge with collector ring removed and case raised. Most of the necessary servicing can be done when the case is in the position shown.

A fact to consider is that the data for this study were derived from only one gage, that is from point rainfall—the one at Hackensack was the only 24-hr. recorder accessible to us. Obviously the maximum intensity for all these storms did not occur at the gage site; other areas likely received storms of even greater intensities. Similarly, it is true that some were considerably less hard hit. This variation is illustrated by comparing total rainfall figures recorded at Hackensack for the four significant storms with observations from three other recording stations in the county (Table 3). The bold face figure is the highest for each storm. On three of the

four dates the Hackensack gage did not receive the most precipitation. As a matter of fact, the Hackensack gage location was above average only once. It is interesting to note that the one storm for which the Hackensack gage recorded the highest catch indicates a maximum return period of 9.7 years. One or more of the other gages may have recorded even rarer events but this possibility was not investigated.

The results of the study clearly indicate that Bergen County truly experienced an abnormally rainy summer in 1960. From the above data it is apparent that it should not be regarded as a representative year in the evaluation of design standards

for existing and proposed structures. This is particularly true in the smaller drainage areas where structures such as storm sewers may be designed for from two to ten-year return periods. The results clearly demonstrate that an increase in the number of damaging minor floods should have been expected when the rainfall pattern is taken into consideration.

Our hopes at the county engineer's office are for a more normal series of summers after the extreme one of 1960.

• • •

Progress Report on the Interstate Highway Program

Almost 10,600 miles of the 41,000-mile national system of Interstate and Defense Highways are now open to traffic and construction is under way on another 4,400 miles. 1,866 miles of the System were completed to final standards during the past 12 months, of which 173 miles were completed during the quarter ending March 31.

The actual mileage in use by passenger and commercial vehicles rose from 8,855 a year ago and from 10,440 as of December 31, 1960, the date of the last survey, to 10,597 as of March 31, thus, almost 26 percent of the Interstate System is now open to traffic.

The Interstate System will be the Nation's key highway network, carrying about 20 percent of the total traffic. Of the 10,597 miles of the Interstate System now in use by motorists, 5,308 miles were completed to standards adequate for 1975 traffic, and 3,022 miles were improved to full capability for handling current traffic but will need additional improvement to bring them up to the standards for 1975. Toll roads, bridges, and tunnels incorporated in the system, as permitted by law, totaled 2,267 miles.

More than half of the mileage open to traffic, 6,018 miles, has been built or improved under the Federal-aid Interstate program, most of it on the 90-percent Federal, 10-percent State sharing program launched in 1956. In addition to the sections open to traffic, 4378 miles were under construction with Interstate funds as of March 31, and engineering or right-of-way acquisition was in progress on another 10,408 miles. Thus some form of work was under way or completed on 25,383 miles of the 41,000-mile system—about 62 percent of the total.

Table 3—Total Inches of Rainfall for Significant Storms in 1960

Date	Hackensack	Allendale	New Milford	Woodcliff Lake	Average
July 3	1.67	1.36	1.26	1.83	1.53
July 30	2.86	3.16	3.12	2.73	2.97
August 10	1.62	1.81	1.83	1.61	1.72
August 15	1.06	0.02	1.00	0.60	0.67

TRACTOR SEAT Wired for Safety

RAYMOND W. PECAUT

Equipment Superintendent,
Ohio Turnpike Commission,
Berea, Ohio

OPERATING over rough terrain and on steep slopes is a necessary part of most highway mowing programs. Such operations are not without hazards, even to the skilled equipment operator. One ever-present danger is the possibility of an operator being thrown or falling from the seat of the tractor while the tractor continues to move, subjecting the operator to the possibility of being run over by the tractor wheels or struck by the mowing equipment.

While the Ohio Turnpike maintenance crews have never experienced an accident of this nature, the need for a safety device to prevent such an occurrence was apparent.

With the acquisition of new utility tractors with mounted mowing units, a safety belt, designed by the author, was installed by Turnpike personnel to assure maximum safety in the operation of this equipment. All utility tractors owned by the Commission were already provided with the safety feature that requires the clutch pedal to be depressed before the starter will work. This arrangement assures that an operator is in position and the clutch disengaged before the engine can be started.

The new safety belt completes the cycle by assuring that the driver remains in the seat in order for the engine to continue to operate.

Most tractor manufacturers can now provide equipment incorporating the safety feature requiring that the tractor be out of gear before the starter will operate. A similar arrangement can be readily added on older tractors already in use. All that is required is a stop-light switch installed so that it will turn "on" when the clutch pedal is completely depressed. The wire leading from the starter switch to the starter solenoid is cut and the stop-light switch wired into the circuit so that

the current from the starter switch must pass through the stop-light switch before reaching the solenoid.

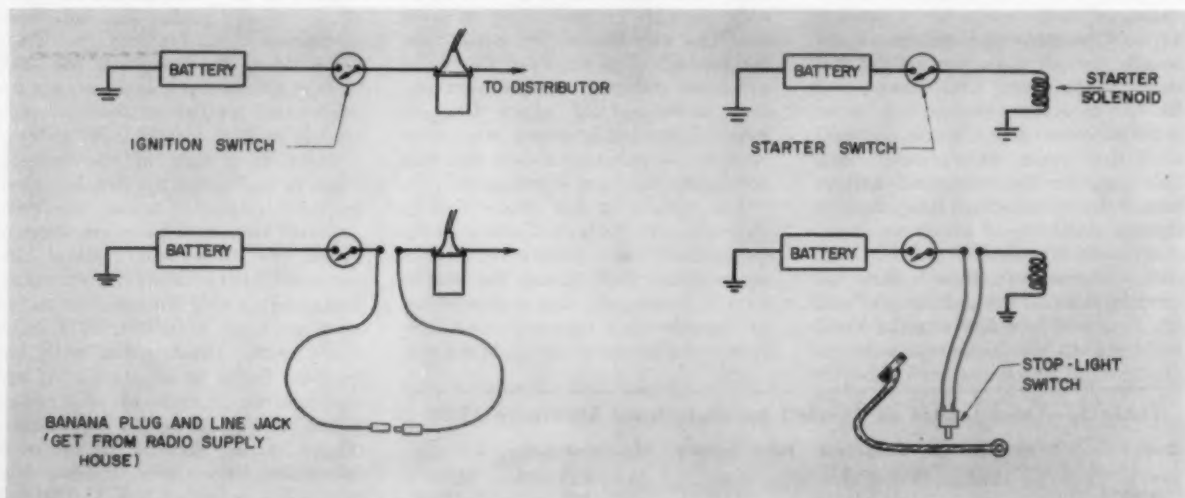
Automatic Shut-Off

There are several ways in which a tractor can be stopped when the operator falls or is thrown from the seat. The scheme selected for Turnpike units is one which provides for the engine to shut off automatically whenever the operator leaves the seat. This is accomplished by installing a loosely fitting "safety belt" of very flexible, heavy-gauge, insulated wire, equipped with a banana plug and line jack so that the wire may be plugged together on the operator's lap. It is important that the female plug be the "hot" line so that there is no danger of the exposed terminal of the male plug shorting against other tractor components (and possibly starting a fire in the event of an upset and gasoline spillage). The fit of the belt must be loose enough to permit normal bouncing and jostling but not so loose as to dangle and interfere with tractor operation. Inasmuch as the girth of equipment operators varies considerably, an adjustment feature is provided.

The "electronic safety belt" is wired into the circuit between the ignition switch and coil, so that current must pass through the belt before it can get to the coil. Thus the belt must be plugged together in order that the ignition may work. For stationary operation of the tractor with post-hole diggers, backhoes or other attachments which require frequent mounting and dismounting, the belt can be connected and pushed to the rear of the seat, free of the operator.



● SAFETY belt is shown on the tractor seat. Belt is wired into ignition circuit and must be plugged in before engine can start. Breaking circuit stops tractor.



● SAFETY belt wiring in simplified form at left, showing how belt is cut into line between the switch and distributor.

● SAFETY clutch pedal operation. Wiring requires that operator is in position and clutch disengaged before starting.

Pumping Water at Variable Speed —WITH EFFICIENCY

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O'Brien & Gere
Consulting Engineers
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A CENTRIFUGAL pump, because of its inherent characteristics, is a machine ideally suited to variable speed operation. Its capacity varies as the speed; the head it develops varies as the square of the speed; and the horsepower required to drive it varies as the cube of the speed. Moreover—and this is most important—its efficiency is almost entirely independent of the speed, as long as the efficiency is measured at equivalent points on the pump characteristic.

Reference to Figure 1 will make this latter point clear. $H-Q$ is the head-capacity curve, and $E-Q$ is the efficiency-capacity curve of a typical centrifugal pump at the full rated speed. H_1-Q_1 is the head-capacity curve at a speed reduced to 75 percent of rated speed. Curves (1) and (2) are any two parabolic curves passing through the origin, 0.

The pump efficiency at all points located along the curve (1), such as A and A_1 , remains substantially constant and equal to the efficiency at C , vertically above A . The same relationship holds true for other parabolic curves such as (2), and can also be expressed in terms of the specific speed, a factor of great significance in the design and application of centrifugal pumps.

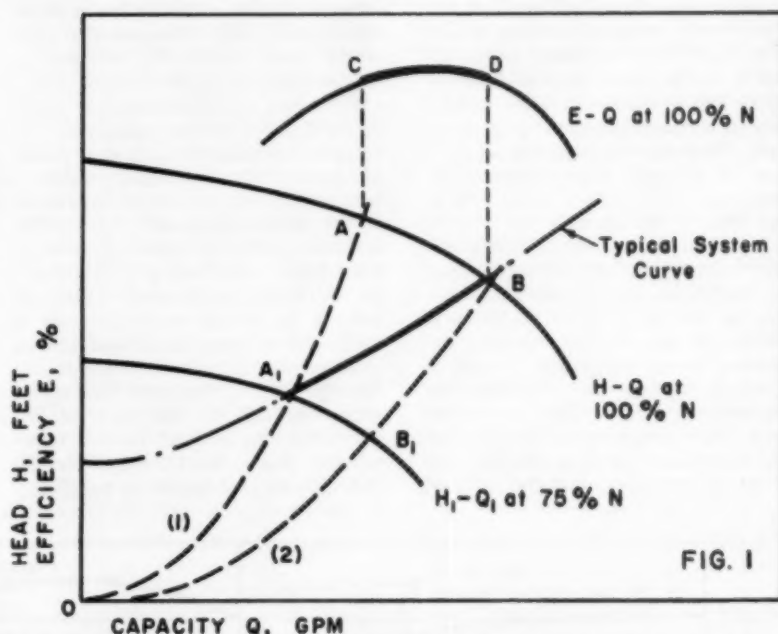
Specific speed N_s , is defined by the equation:

$$N_s = NQ^{1/2} \div H^{3/4}$$

and is a dimensionless number. Parabolic curves, such as (1) and (2) are loci of the points of constant specific speed.

As long as the specific speed remains constant, the pump operates under hydraulically similar conditions, and its efficiency is substantially constant.

The actual operating point of any pump installed in a system is the point of intersection of the pump characteristic curve and the system curve. All system curves are roughly parabolic in shape but they seldom,



● TYPICAL application of a variable speed centrifugal pump. Over the heavy portion of the system curve, the pump efficiency is contained between points C and D.

except in the case of a closed circulating system, pass through the origin. It is this similarity between the system curve and the constant pump efficiency curve which, on many systems, makes it possible to apply a variable speed centrifugal pump so that it will operate at a high and reasonably constant efficiency over a wide range of flow and head conditions.

Overall economy of operation, however, depends on the combined efficiency of the pump and drive unit or, as it is commonly expressed, the "wire to water" efficiency. With the predominance of AC electric drives, especially in sewage and waterworks applications of centrifugal pumps, the excellent variable speed characteristics of these pumps are not taken advantage of as often as they might be. The AC induction motor, that workhorse of industry, unfortunately is not readily adaptable to variable speed operations.

Adjustable speed drives, using power from an AC distribution system, have been available for a num-

ber of years. Most of these achieve speed variation through regulation of the slip between the rotating primary magnetic field and the output-shaft of the drive, as in the wound-rotor motor, the magnetic coupling or the hydraulic coupling. The efficiency of all such drives is inversely proportional to the slip. The slip power which, at any speed, is proportional to the slip speed and to the torque at that speed, appears as heat in the secondary resistors of the wound rotor motor, as core and copper losses in the magnetic coupling, or as temperature rise of the fluid in the hydraulic coupling. In most cases this is waste power converted to heat which must be removed and, in the larger installations, the removal of this heat may require quite elaborate auxiliary systems.

Introduced recently to the field of water works is a new type of adjustable speed drive which overcomes some of the deficiencies noted above. Essentially a two-motor drive, it consists of an AC wound rotor component and a DC shunt-wound component; it is marketed

by Westinghouse under the trade name "Rectiflow" drive. Available in several forms, the two components may be separate machines belted together or they may be mounted on a common shaft, vertically or horizontally.

The first waterworks installation using this type of drive is a fully automatic booster pumping station designed by O'Brien & Gere for the Onondaga County Water Authority. Placed in operation in May, 1960, the Park Street pumping station is part of a \$4,000,000 program of improvements undertaken by the Authority to improve service to the metropolitan area outside the city of Syracuse. This station, constructed at a cost of \$103,000, has a design capacity of 4.0 MGD, at heads varying from 50 to 135 feet.

The AC/DC drive operates directly from standard AC line power applied to the AC wound rotor component. As the speed of the drive is decreased, the AC slip power, instead of being dissipated as heat, is rectified through silicon diodes to the armature of the DC component to provide useful torque. The output capabilities of the drive are the sum of the torque outputs of the AC and

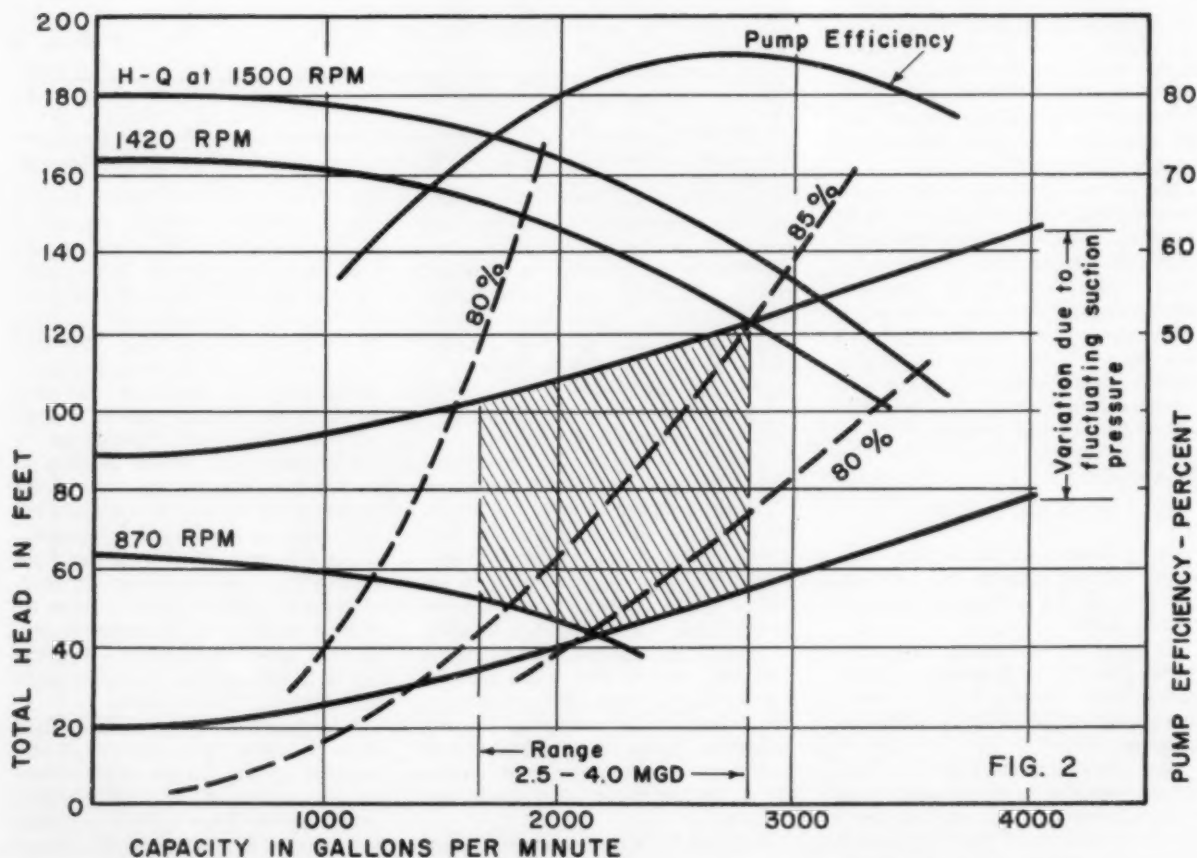
DC components. Therefore, inherently the drive has a constant horsepower characteristic. Generally, speed regulation of the drive is about 5 to 7½ percent over the entire operating range, but it can be as low as two percent in the higher horsepower ratings, i.e., 200 to 500 hp. The drive cannot exceed the synchronous speed of the wound rotor component, since the units are normally directly coupled together. When belted together, a mechanical overspeed device is required to limit the speed of the DC component in the event of a belt failure.

Efficiency of the adjustable speed AC/DC drive is very high, and it is relatively constant over a wide range of speeds. This is very important in a pump application, since operation at the maximum speed is generally required only to meet maximum conditions which occur infrequently. A high, maintained efficiency over a range of conditions has a real value in terms of reduced power.

Speed control of the drive is infinitely adjustable over its speed range through the variation of DC current to the field of the DC component. The control voltage for the field circuit is obtained by rectifying

stepped-down AC line voltage. In short, the AC/DC drive has the operating characteristics and control flexibility of a standard DC motor, but can operate directly from an AC power source. Starting current of the drive can be easily limited to 100-150 percent of full load current. Normally, only one step of starting is required.

The Park Street pumping station serves a portion of the Water Authority's system in a rapidly growing residential and industrial area. Widely variable suction pressure and the requirement of maintaining the discharge pressure within very narrow limits, regardless of the rate of flow, predicated the use of variable speed pumps. It is interesting to note that this station lifts water from a hydraulically weak transmission line into a strong distribution system with ample capacity, and consequently with relatively flat hydraulic gradients. The minimum discharge pressure required to fill elevated storage on the distribution system is 105 psi; the permissible maximum discharge pressure, established by the safe working pressure of some of the older distribution mains, is 115 psi.



● HYDRAULICS of the Park Street Pumping station of the Onondaga County (N. Y.) Water Authority.

Hydraulically operated butterfly valves are used in place of the usual check valves to eliminate the water hammer and surges which generally accompany the action of check valves. The experience and records of about 8 months of operation since the station was placed in service, indicates that the combination of infinitely adjustable pump speed and of the slowly opening and closing valves has resulted in complete elimination of surges and in discharge pressure being maintained within plus or minus 2 psi of the desired pressure (110 psi).

Water level from the remote elevated storage is telemetered to the pumping station. This signal is used to start and stop the two pumps, in sequence, through a wear-equalizing automatic alternator. There are several sequenced steps in the starting cycle which must take place in the correct order and within the prescribed time, or the controls shut down the pump, which then requires a manual reset before being started again.

The speed control is achieved by a pneumatic control instrument which continuously compares the actual discharge pressure to the ref-

erence pressure (set point) and automatically adjusts its output signal to the pneumatically actuated field rheostat, which in turn regulates the speed of the pump. The instrument has a proportional and reset action. Response of the control system to changes in suction pressure is very fast and accurate. Since the hydraulic time constant of the station piping is negligible and the drive itself has an extremely high acceleration capacity, very close control and exceptionally fast response are possible. The author has experimented with the system adjustments to the limits of stability, and has found that with the proportional band set at 10 percent and the reset time set at about 12 seconds, the system has the capability to maintain the discharge pressure within 1 psi of the set point, and to regain stability within 5 seconds following an instantaneous change of the set point through about 20 psi. Normally, however, the system operates at much more conservative settings.

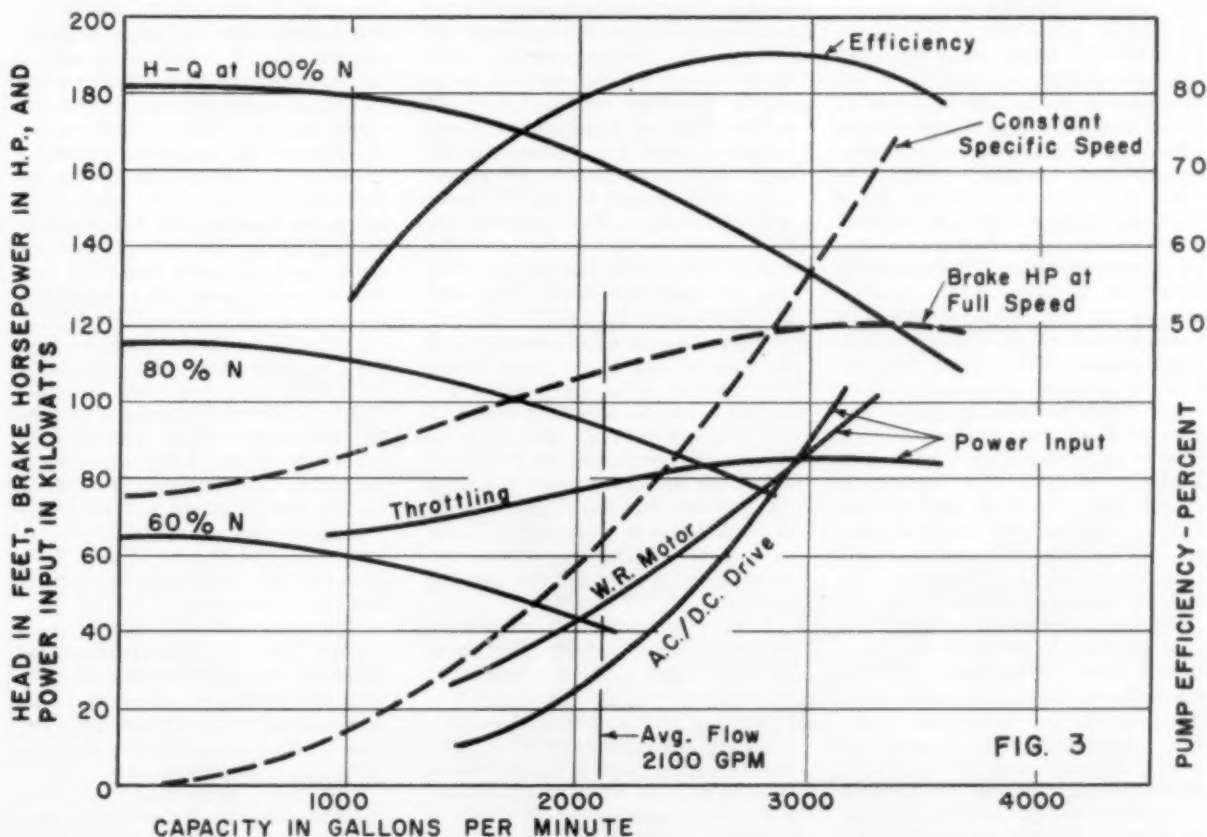
Figure 2 shows the hydraulic conditions which prevail at the Park Street Pumping Station. It will be noted that the static suction pressure has a variation of 70 ft., or almost 50

percent of the rated head of the pump at 1500 RPM (approximately 135 ft). The shaded area represents the range of usual operating conditions. This area is roughly bisected by the curve of constant specific speed at 85 percent efficiency. It is seen that, over the operating range, the average pump efficiency is well over 80 percent. The overall, or "wire to water" efficiency over this range averages about 65 percent.

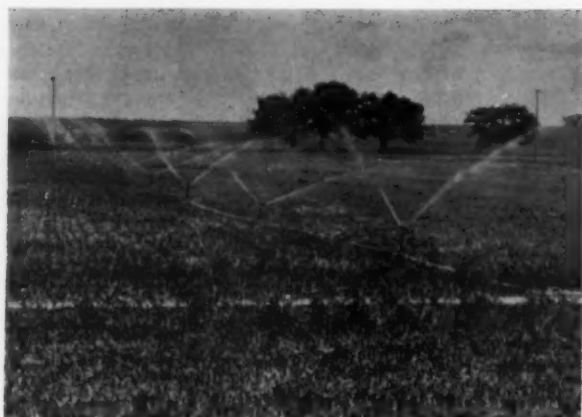
The curves in Figure 3 bring into focus the operating economy of the adjustable speed AC/DC drive, when applied to a centrifugal pump load. The design objective at the Park Street Station also could have been achieved by the use of, say, wound-rotor motor driven pumps, or of constant speed pumps with automatically throttled discharge.

Power input was computed and plotted for the three alternate methods, viz., the AC/DC drives, the wound-rotor motors and the throttling method. In the case of the first two methods, which involve variable speed operation, the constant specific speed curve at the 85 percent efficiency was assumed to be the median system curve. This is a

(Continued on page 180)



● CAPACITY control by throttling at constant speed vs. variable speed control, wound rotor motor or AC/DC drives. In this study the dash curve of constant specific speed approximates the median system curve at the Park Street station.



● SPRAY irrigation of cannery wastes is practiced on pasture land. Applications to 10,000 GPAD do not result in runoff.



● RIDGE and furrow system for treating milk plant wastes. To show layout, photo was taken before grass was established.

IRRIGATION DISPOSAL of Industrial Wastes

THEODORE F. WISNIEWSKI

Director, Wisconsin Committee on
Water Pollution
Madison, Wisconsin

IN RECENT years, many types of industries have recognized the use of irrigation on land as a means of disposal of industrial wastes which effectively eliminates water pollution by such wastes.

Spray irrigation methods were first applied to the disposal of cannery wastes because these wastes are produced seasonally during the period of the year when suitable grasses can be depended upon to remove much of the water through evapo-transpiration. Since, on the average, growing crops can remove about 5,000 gallons of water per acre per day by this process, designs have usually been based on use of sufficient area so that application at the rate of 10,000 gallons per acre per day will not result in runoff. The excess not transpired percolates into the soil and is lost through soil absorption.

The spray irrigation method was next applied to disposal of dairy wastes. This year-around industry encountered difficulties with spray irrigation during the winter. Problems developed with freezing of pump controls and of pipelines. Modifications, such as provision of a separate wet pit with an adjoining dry pit for the pumps and the proper grading of the pipelines for drain back to the wet pit, partially

solved the problem. It was soon found that alternate thawing and freezing destroyed the grass crop so that twice the design area was needed if spray irrigation was to be continued through the winter.

Ridge and furrow irrigation was then developed for disposal of dairy wastes. Here the land area required is the same as for summer spray irrigation, and the system can be used all year as grasses are grown only on the ridges to which wastes are not applied. The furrows are generally one foot wide and six inches deep, with the ridges from five to eight feet wide. The total irrigation area is usually divided into three sections with one-third of the area in use at one time. When one area is saturated, wastes are directed into the adjoining area and the original area allowed to rest. Grasses are permitted to grow tall. In winter the tall grasses fold over the furrows, and the added blanket of snow helps to provide insulation so that the field continues in use through the winter without freezing up.

Poultry processing plants, pulp mills, and meat packing plants also utilize irrigation as a method of disposal of wastes. Spent sulphite liquor has been disposed of by distribution over land from a tank truck equipped with spraying equipment to produce a fog-like dispersal. For this waste sufficient land is needed so that application of total solids will not exceed 1 lb. per sq. yd. per day.

Great care must be exercised in selecting the site so that abatement of surface water pollution will not result in ground water pollution. Creviced limestone areas are unsatisfactory for irrigation disposal for this reason. Soil borings should be made and also percolation tests. In tight soils where percolation rates are low, one or two under-drains may be permitted at a depth of three feet below the bottom of furrows to lower water table in a ridge and furrow field. Sites should preferably be located 500 feet or more from occupied buildings and on the down-wind side, depending on prevailing winds.

Operation of spray irrigation systems requires that careful attention be paid to screening facilities at the sump to prevent clogging of nozzles by solids carried in the wastes. Daily inspection of the irrigation area is necessary to avoid pooling of water on the land surface and to determine a proper schedule for movement of distribution lines. Time intervals will vary with the type of soil being irrigated.

Ridge and furrow irrigation areas require less frequent attention but must be checked from time to time, and the wastes re-directed to an alternate ridge and furrow area before flooding above the tops of ridges occurs in the original area.

The many successful spray and ridge and furrow irrigation systems in Wisconsin are a tribute to the industries that have adopted this means of abating stream pollution.

AERIAL STUDY OF TUNNEL APPROACH TRAFFIC PROBLEMS



● CLOSE-UP of Sonne stereo strip viewer being used to measure vehicle speed.

DURING MORNING and evening rush hours, the western approaches to the Lincoln Tunnel regularly bogged down with heavy traffic. To find out where traffic problems were occurring and why, and to assist in computing the value of possible design solutions to the problem, the Port Authority of New York decided to analyze thoroughly the traffic situation at the approaches. Intent of the survey was to select different time periods and retrieve individual vehicle speeds summarized by vehicle type, lane, roadway segment, time and direction of travel, as well as to obtain a general look at the entire approach system at virtually one time.

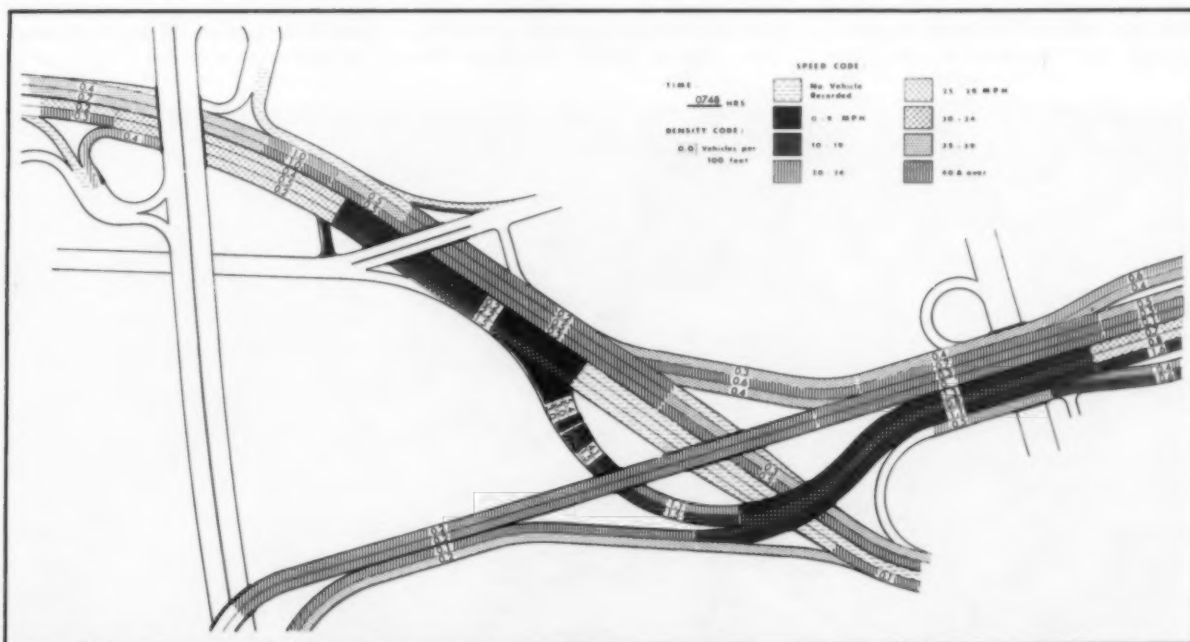
The Port Authority pioneered in the traffic engineering field by utilizing continuous strip aerial photography developed by Chicago Aerial Survey, Division of Chicago Aerial Industries, Inc., Franklin Park, Illinois.

Photography by its nature is an excellent traffic recording device due to the amount and diversity of information that can be gathered simultaneously. Aerial photography has been used for many years, generally within specific locations such as an intersection. By using strip photography, Port Authority traffic experts were able to look at one continuous photo that virtually "painted" traffic information on the

film. In the analysis, 3,260 vehicles were photographed by a Chicago Aerial plane in less than ten minutes of flying time. With continuous strip photography, numbering and data collection was done easily and at a high rate of speed.

What is strip photography? In simple terms, it's a normal picture stretched out indefinitely with the length of the film being the only limitation. An individual "picture" can be up to 400 feet in length. At the scale flown on the Port Authority study, it would be possible to photograph 230 miles of roadway on 400 feet of film.

To get accurate vehicle speeds, technicians from Chicago Aerial



use a Sonne camera with twin lenses. One lens looks ahead of the aircraft, while the other looks slightly behind. The forward-looking lens sees an object about half a second before the other lens. Each lens exposes half of the film. Since the distance between the lenses is known, and the plane's speed is known, it is possible to calculate the distance a vehicle travels and, therefore, its speed.

In the Lincoln Tunnel operation twenty-three flights were made of an area that included a section of Route 3 and the New Jersey Turnpike, west of the Lincoln Tunnel, a centerline distance of about 2.2 miles. Eleven flights were made between 7 a.m. and 9:30 a.m., with twelve flights being made from 3:20 p.m. to 6:30 p.m. Of the 23 flights, eight flights or traffic situations were chosen for intensive analysis. In both rush periods the choice was one pre-peak run, two runs during heaviest traffic and one run after traffic began thinning out. Chicago Aerial turned the photos over to its Economic Geography Department where photo interpreters and traffic analysts divided the entire study area into segments. Break points for each segment were located at merging points, ramp entrances and exits. Then each segment and vehicle in each segment was numbered.

Measurements of each segment, along with various other factors, such as ground speed of the aircraft, vehicle type, lane position, time period, segment, vehicle number, and the change in lanes were recorded on IBM data input sheets.

Speed calculations and data summarization was accomplished by Chicago Aerial's data processing equipment. The output data was a new set of IBM cards and tabulated summary sheets.

An unusual and effective form of data presentation called Speed Flow Diagram was designed to effectively evaluate speed variation by type of alignment and intensity of flow. A plan drawing of the study areas with exaggerated lane widths and segment divisions was made. The longer segments were then subdivided and a separate drawing was used for each flight time period analyzed. Vehicle speeds by lane, segment, sub-segment and time period were retrieved from the IBM cards and average speeds were computed by lane for each segment for each flight. To make the analysis job easier, average speeds were applied to the plan drawing through a color code.

The choice of colors creates a bright color for low speeds, changing to more subdued colors as average speed increases. The result is a visual presentation of average speed variation by lanes along the entire route for each time period studied.

To give more meaning to the average speed representation, a density factor was computed for each lane and noted on the drawing. Density was measured as the number of vehicles per 100 feet of lane.

This overall view of the study area gives a most effective relationship between alignment friction and vehicle speed variation. The

bright colors make the breakdown points stand out in an extremely useful manner and the density figure adds a further dimension to the diagram's usefulness.

There is no other method by which such a variety of significant data can be collected at one time in one medium. Particularly significant is the fact that the photographic medium provides a permanent visual record of the test environment from which data is collected. The advantage of this over field collection is twofold: 1) Measurements can be made leisurely under laboratory conditions and 2) the data abstraction process is repeatable. Part or all of the data can be collected as the situation requires.

Photo experts at Chicago Aerial stress that strip photography for traffic analysis is not for everyone. They point out that strip photography gathers a tremendous amount of raw data suitable for later analysis. If the need for traffic data is simple, such as counting the number of vehicles passing a given point in twenty-four hours, then tapes or counters will do the job. Strip photography comes in when the requirement is for detailed analysis of more complex situations. The Lincoln Tunnel study is a good example, as are such sophisticated road systems as Chicago's Congress Street Expressway and the freeways of Los Angeles.

First comments from traffic engineers indicate the experts have found a valuable new tool to study traffic congestion on major municipal and state arteries.



● LINCOLN Tunnel approach illustrates use of strip photography. Vehicles appearing as long blurs are traveling fast.



LANDSCAPE DEVELOPMENT POLICIES for the Interstate Highway System

RECOGNIZING the vital importance of close collaboration of all segments of a highway organization to bring about the "complete highway" required to carry Interstate traffic, the American Association of State Highway Officials' Operating Committee on Roadside Development has prepared a comprehensive "Policy on Landscape Development for The National System of Interstate and Defense Highways." The Committee, under the chairmanship of Howard S. Ives, Connecticut State Highway Commissioner and with the cooperation of the AASHO Subcommittee on Policies and Standards for Roadside Development, headed by Wilbur H. Simonson, Chief, Roadside Branch, Bureau of Public Roads, completed and approved the draft of the policy in October, 1959. After review and voting was completed by the states, the final draft was formally approved and adopted as an official AASHO Policy on Jan. 25, 1961.

Like the preceding AASHO Policies which have served as the axioms of our national highway technology, this new landscape development policy will have a lasting impact on our Interstate highways and a significant influence on our entire street and highway system. While a comprehensive coverage of the contents of the new policy is beyond the scope of this article, condensations of the major features are quoted in the following paragraphs.

Statement of Policy

Landscape development, to be effective, should begin with an analy-

sis of the land use prevailing along the proposed route, looking toward the possibilities for conserving all desirable landscape features and land values. In order that the natural features of the route may be preserved, attention should be given during the preliminary planning stage to those elements of location and design that add to the attractiveness of the route. These include variation in median width, differences in elevations of separated roadways, the architectural design of structures, and diversity in roadside development. The ultimate highway landscape development should be visualized in three dimensions; roadway alignments, profiles, and cross sections—each of these so coordinated as to produce a facility that will be attractive and appealing to the motoring public. Landscape development also aims to avoid monotony and over-standardization and to protect and develop the amenities by minimizing the detrimental effect of traffic on nearby properties.

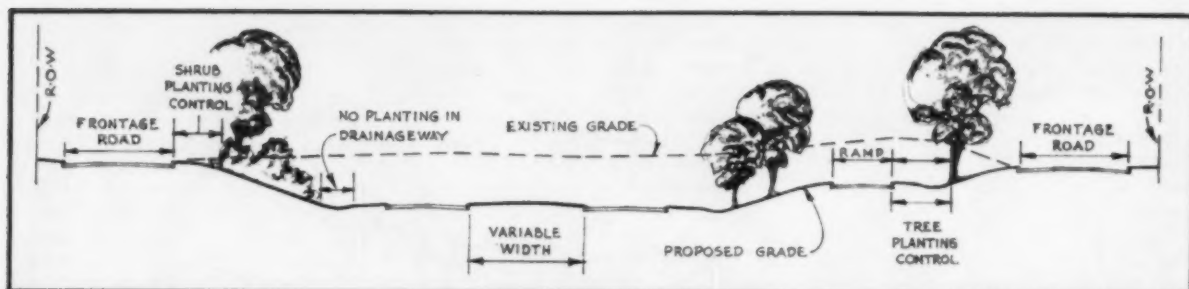
Engineering requirements and landscape architectural objectives should be carefully coordinated during the stage of location and design. The designer should take full advantage of the natural lay of the land and of natural and manmade features of the route. Where feasible, adjustments in alignment, profile, and cross section should be made to reduce disturbance and possible damage to streams, trees, and other natural features. The designer should try to preserve the natural slopes within the right-of-

way. He should not overlook possibilities for saving areas of undisturbed woods and sites for safety rest areas as a part of the total design. Conservation of such landscape features frequently results in the introduction of terrain-fitting curvature in place of long tangents in alignment; thereby reducing the areas of cut and fill slopes and providing a reduction in the cost of erosion control measures as well as reducing annual highway maintenance. Desirable trees which will not interfere with construction or future traffic should be saved.

All related information such as land use plans, aerial photographs, and topographic maps should be utilized in exploring the possibilities for the conservation of these landscape features in order to provide a useful, economical, and attractive highway facility that is less-fatiguing, and thus safer to drive.

Right of Way and Cross Section

The proper width of right-of-way for the development of a complete highway is influenced by the anticipated traffic, the design of interchanges, the cost of land and the improvements thereon, as well as the anticipated changes in land use on adjacent areas. The width of right-of-way to be acquired is also influenced by the topography, protection against erosion, and other landscape developments such as appropriate planting for noise abatement and other purposes. Selection of sites for interchanges, weight stations, and rest areas will also affect right-of-way design width.



Drawings courtesy AASHO

● **TREE, shrub and groundcover planting controls for an urban section of divided highway with ramps and frontage roads.**

Normally, excepting certain urban right-of-way limitations, a width of at least 50 feet of roadside border should be provided beyond the outer edges of roadway shoulders. Adequate width of right-of-way is particularly needed where buffer planting is required for the abatement of highway noise. On rural highways, additional right-of-way is often acquired to natural demarcation lines such as streams, shorelines, cliffs, and tops of ridges; whereas in urban areas, right-of-way boundaries are more often determined by building lines and costly improvements on the land.

The typical cross sections of highway construction plans should show the full width of right-of-way required for all necessary elements, including median, pavements, shoulders, gutters, cut and fill slopes, border areas and frontage roads.

Slope grading, drainage, and erosion control are closely related and should be considered together in the design of the cross section. All angles at change of earth slopes should be rounded at the outer edges of shoulders, tops of cuts, and at the toe of fills. The limits of slope rounding should be clearly shown on the plans as a requirement of roadside work by the contractor. In special situations, such as at in-

terchanges, grading plans should be prepared with contour lines to show the proposed development.

Rounded gutters and drainage channels should be provided. The side slopes should be reasonably flat so turf can be readily established and maintained with power equipment. In built-up areas, however, where the width of right-of-way is restricted, relatively narrow channels with steep paved side slopes are sometimes necessary. Underground storm sewers may be resorted to in some cases. In humid regions, drainage channels carrying only occasional surface water may have a turf cover. Where water volumes or velocities are high, paving of the channel should be considered to avoid possible saturation of the soil. In dry regions where turf cannot readily be grown, paving of drainageways including the use of intercepting channels, dikes, and flumes, should be provided as protection against surface water erosion. In all regions, paved drainageways should be provided to carry a steady flow of water such as from springs.

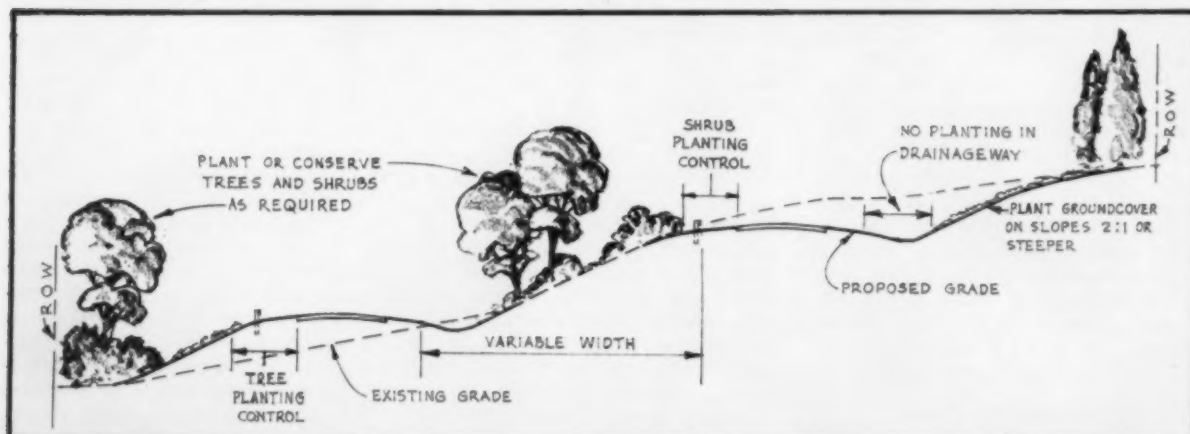
All earth cut and fill slopes should be rounded and warped as necessary to merge the highway into the terrain to encourage rapid establishment of a vegetative cover, and

to provide for economy in maintenance. Warping or transitioning of earthwork grading at the ends of cuts and fills should be accomplished in a natural manner to avoid a uniform slope through an entire cut or fill (earth) section.

Slopes with a 3:1 (3 horizontal to 1 vertical) and flatter ratio favor the establishment of turf growth as a protection against erosion and permit the economical use of power mowers. On 2:1 slopes (in humid regions) which are too steep for power mowing, various groundcovers such as vines and shrubs may be planted to prevent erosion. Where feasible, selected portions of grass-covered slopes should be left unmowed, subject to occasional herbicide or other treatment as necessary to control undesired vegetation, in order to encourage desirable native growth as a permanent ground cover. Retaining walls should be considered where space restrictions require earth slopes steeper than a 2:1 ratio.

Erosion Protection

Planting, riprapping, masonry wall construction or other special protection against stream and wave erosion should be provided as necessary especially where earth embankments parallel streams or



● **LANDSCAPING proposed for rural sections of divided highway in hilly topography with roadways at different levels.**

shorelines. A protective strip of undisturbed woods or brush land should be saved wherever possible between shores and highway embankments by adjustments in alignment to avoid the need for artificial protection against erosion. Likewise, changes in stream channels that may increase stream velocities and increase erosion of stream banks should be avoided wherever possible. When excavation is necessary within the channel of a stream, care should be exercised to minimize subsequent channel erosion or changes in channel gradient which may cause siltation and the formation of sand and gravel bars or an increased stream velocity during periods of flood with resulting damage to embankments and bridge footings downstream. The designer should also anticipate the effect of changes in land use adjacent to the proposed construction which would result in increased run off during floods and thus require protective measures to control slope erosion.

Medians

Long sections of tangent alignment and narrow median of fixed width should be avoided. Independent roadways designed with flowing alignments and profiles at different levels to fit topography and favor the cost of land and the design of interchanges, provide variation in the cross section and the alignment every few miles. The following advantages of variable alignment-cross section design should be considered: 1) Excavation quantities reduced by terrain-fitting alignments; 2) natural drainage channels in medians eliminate need for costly storm sewers; 3) woodland, streams, and other natural features preserved; 4) glare of headlights eliminated where natural woodland growth is preserved; 5) damage to adjacent land values avoided by adjustments in roadway alignments and profiles; 6)

cost of erosion control reduced in medians and on side slope areas of cut and fill; 7) cost of maintenance such as mowing and snow removal reduced by preservation of natural growth and natural drainageways; 8) monotony in appearance avoided; 9) flexibility afforded in roadway and interchange design; and 10) increased interest and safety for motorists, improved overall appearance, and decreased future maintenance provided in the total long range development.

Future traffic lane requirements should be anticipated in the initial design of the cross section. Trees are generally undesirable in medians of limited width because of the hazard to moving vehicles, and should not be saved in locations that interfere with drainage, cause snow drifting, or constitute a hazard to traffic. Desirable existing trees should be saved in appropriate locations in wide medians where not less than 20 feet of clearance is provided between trees and edges of pavements.

Interchanges and Rest Areas

An entire interchange area should be designed as a unit in relation to the surrounding topography and the potential development of the adjacent land. The grading plan method is the best way to visualize and analyze the design of the area as a whole and accordingly grading plans should be prepared to show the relation of the proposed construction to the existing ground surface.

Rounded slope grading, drainage, erosion control, and planting should be correlated with the design of all interchange roadways and structures, not only to enhance the appearance of the area but also to keep construction and maintenance costs to a minimum. Desirable existing growth remaining in undisturbed areas, should be saved where possible; and where practicable, appropriate planting should be provided

for erosion control, traffic guidance, and other purposes. Existing growth and proposed planting should not be permitted to interfere with sight distance requirements within the interchange area. Grading plans and planting plans should be correlated.

The landscape features in the design of safety rest areas and their scope of development are included in a Policy on Safety Rest Areas for the National System of Interstate and Defense Highways, AASHO, adopted April 30, 1958. Examples of safety rest area design illustrate application of the policy as to kinds of areas, location and spacing of sites, factors in site selection, and layout and design.

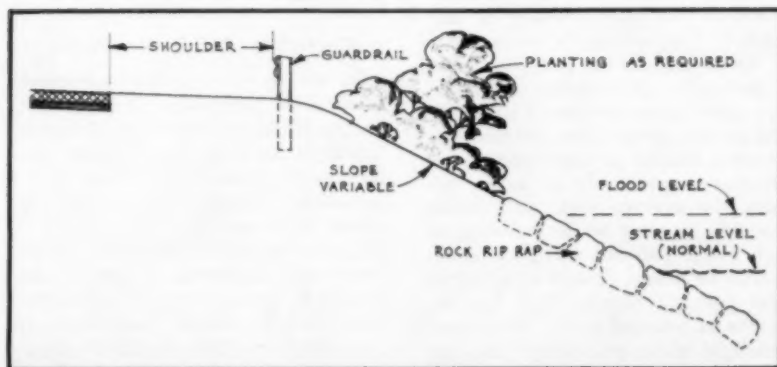
Tree Protection

Subsurface utilities should be located to avoid damage to root systems of existing trees and changes in drainage conditions unfavorable to tree growth. Where pole lines or subsurface utilities are necessary within an interchange or safety rest area, the location of such facilities should be carefully determined and shown on the plans in proper relation to other features of design such as existing trees and proposed grading, drainage facilities, highway signs, and planting. Overhead wires within the highway right-of-way, if any, should be located to avoid the need for tree trimming.

Existing trees outside of the areas staked for clearing and grubbing should be appraised either for preservation or for removal. Precautions should be taken for the protection of all desirable trees from damage during construction operations.

Desirable trees outside clearing and grubbing areas should be preserved providing they do not interfere with sight distance or otherwise form hazards to traffic. Existing trees that provide shade, frame views, or have other value, should be saved on outer roadside borders and in medians where there is adequate clearance from the edges of pavements: not less than 25 feet on roadside borders; and at least 20 feet in wide medians. Injuries to trees designated for preservation should be repaired in accordance with approved tree surgery methods.

Desirable trees should be saved where adjustments in roadway alignments and slope grading are feasible since the cost of preserving trees within areas of cut and fill is not often warranted. Tree walls to protect trees within cuts should be limited to trees of outstanding value in locations favorable to survival.



● TYPICAL example of embankment design for protection against stream erosion.

The construction of wells to protect trees in fills should be limited to trees of outstanding value where fills over root systems are not more than 3 or 4 feet in depth and adequate aeration of root systems is feasible.

Planting Design

Well-designed landscape planting should serve a specific function. Because trees and shrubs create a third-dimensional effect in the landscape and require special design considerations, planting plans should be prepared to show the proposed planting design for the development of the right-of-way and special areas of highway projects. Before planting plans are prepared, however, each highway project should be analyzed in the early planning stage to determine the purposes for which planting may be needed, and the controls governing the feasibility of planting and influencing the planting design.

Limitations of climate, rural or urban surroundings, width of right-of-way, planting clearances from edges of pavements, scale of project, and future maintenance should be considered in the design of planting.

In general, roadside planting should be restricted to highways in humid regions and to limited roadside areas in dry climate regions where water is available. Planting of trees and shrubs is usually feasible on highways in humid regions where annual precipitation exceeds about 30 inches. Planting in dry climatic regions may be restricted to stream banks, lake shores, or along irrigation ditches in open country; and to limited sections of urban roadsides where necessary watering or irrigation systems may be provided. Watering systems are not feasible on extended mileages of highways. Artificial watering may compensate for inadequate rainfall, and may be feasible to a limited extent within urban interchanges, traffic islands, or in safety rest and other special rural areas in dry regions. Because of the high cost of watering systems, alternate possibilities should be explored before resorting to such installations.

A generally open planting design should be the pattern followed to achieve the effect of spaciousness. Appropriate planting should be designed to tie the Interstate highway into its environment in keeping with the character of the surrounding terrain and the existing trees and other growth, and the present use or planned development of adjacent property.

On rural highways, preservation of existing woodlands and outstanding trees in medians and on highway borders will often reduce the need for planting. Existing trees and other natural growth conserved during construction should be supplemented as necessary. New plantings may be justified in open areas, on cut and fill slopes, and near interchanges and other structures. Such plantings should be similar to existing growth. Trees and shrubs should be arranged in natural groupings in keeping with the open countryside. Avoid regularly-spaced trees in an extensive row or avenue effect in rural plantings.

In urban areas, intensive landscape development is generally necessary to replace trees and restore amenities lost during construction. In humid regions, shade trees and good turf are essential in residence and apartment house zones at least to meet the appearance of the neighborhood without detriment to land values. Planting is of particular value within urban interchanges, near major structures, and on short sections of residential, school, park or other frontage. In dry regions, planting is more limited and usually restricted to the above types of special areas.

No planting should be done which interferes with safe sight-distance commensurate with the design speed. A minimum planting clearance of 25 feet from the edges of pavements of through traffic lanes should be provided for shade trees planted in median and roadside areas. In interchange areas, trees with ultimate trunk growth over 4 inches in diameter should not be placed closer than 20 feet from the edges of pavements.

Three types of plant materials are mainly effective in highway planting: 1) High-headed large-growing shade trees (deciduous and evergreen); 2) low-headed small and flowering trees; and 3) groundcovers of low shrubs, vines, or turf grasses. The relatively large scale of divided highway projects tends to lessen the importance of shrub-type planting as compared with tree and ground cover types. Shrub-type material should be used only where necessary, preferably in mass, because the average motorist viewing roadside planting while traveling at high speed will not recognize small groups or minor details of planting. Low-growing shrubs may be desirable at selected points to prevent headlight glare and illegal crossing of medians by vehicles, provide crash barriers, and other purposes.

The scale of planting is of major importance on Interstate highways. Where grade separations and bridges occur, tall-growing trees should be used in planting with extensive turf cover or large areas of low groundcover planting. By contrast, small shrub beds are likely to be out of scale, are too small in size to be effective at maturity, and are usually more costly to maintain in good condition.

Maintenance Considerations

In the selection and use of plants, the planting designer should give due consideration to future maintenance in order to minimize interference with mowing, snow removal, and other maintenance operations. When possible, groups of small flowering trees, and low groundcovers should be placed at critical places on high steep slopes to reduce mowing problems. When feasible, shade trees may be planted on steep slopes combined with groundcover to further reduce mowing problems. Plant-bed outlines adjacent to mowed areas should be flowing, to favor mowing practices. Except where required for safety, drainage, snow storage, snowdrift control, appearance or other reasons, slopes should not be mowed, not only for economy, but also because mowing prevents the natural development of indigenous woody plants.

Highway landscape development through coordinated roadway and roadside design takes advantage of terrain and other conditions to minimize monotony and provide economical maintenance with pleasing appearance. The entire area of the right-of-way of controlled-access highways, being wide and inviolate, should be properly planned to promote the safety of traffic and developed so that a roadside pleasing to the road user can be economically maintained and be a credit to the nation.

Complete Policy Available

In the recently printed complete "Policy on Landscape Development for the National System of Interstate and Defense Highways," typical examples of application of the policy are illustrated by a comprehensive series of photographs, drawings and diagrams useful to responsible architects and engineers. Copies of the complete policy can be obtained from the American Association of State Highway Officials, 917 National Press Building, Washington 4, D. C. Individual copies cost 50¢ each.

Studies on OXYGEN DEMAND of Sterile Sewage

Studies showed that the well-known indicator organism, *E. coli*, influences BOD exertion in sewage, but possibly just the carbonaceous cycle.

C. E. KEEFER
Sewerage Engineer,
Bureau of Sewers,
Baltimore, Maryland

THE biochemical oxygen demand of sewage or polluted water is the dissolved oxygen needed by the life processes of all of the organisms in the sewage to stabilize the organic matter present at a given temperature for a stated period of time. Since *E. coli* is one of the predominant organisms in sewage, it was considered of interest to know what part this organism played in accounting for the BOD. To obtain information regarding this question, experiments were conducted in the laboratory at the Back River sewage treatment works, which serves the major portion of Baltimore City.

In 1931 Butterfield *et al* (1) discussed the results of a series of experiments which consisted in part of determining the oxygen requirements of *Bact. coli* used to inoculate a dilute sterile dextrose-peptone solution. It was observed that de-

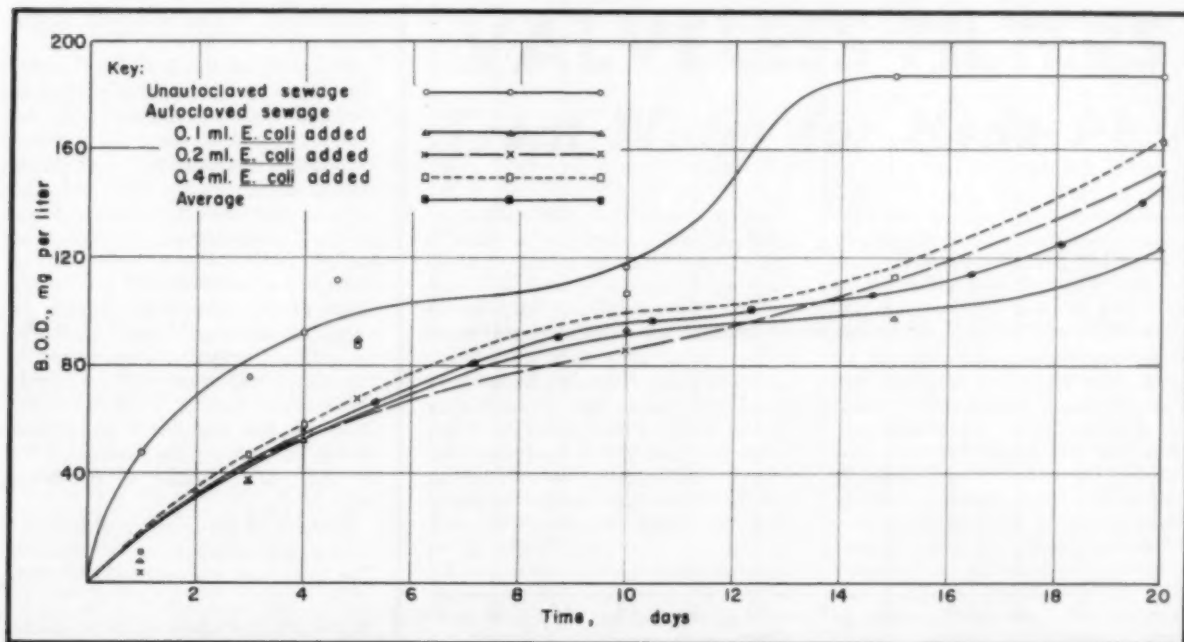
oxygenation occurred only during the growth phase of the organism and then ceased when the maximum count was reached. The depletion of oxygen was greater when the medium was inoculated with a larger variety of organisms. In a later group of experiments Butterfield and Wattie (2) inoculated a sterile dextrosepeptone solution with varying concentrations of *Bact. aerogenes*. They found that during the first 24 to 48 hrs., the greater the initial density of the bacterial population, the greater was the oxygen demand. After about 5 days the oxygen demand of the medium was the same whether there were 3,000 or 3,000,000 organisms per ml. present.

Experimental Method

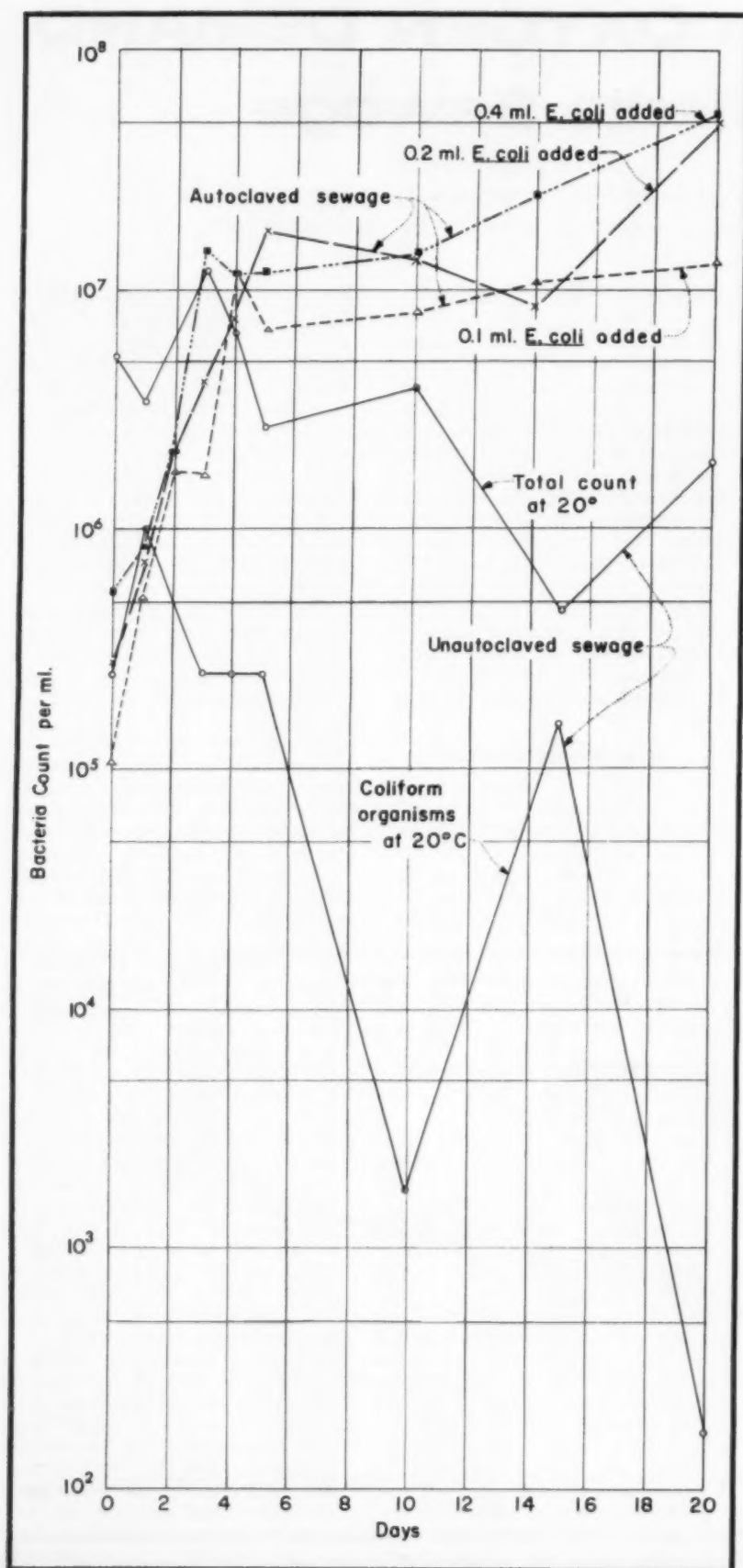
A sample of raw sewage was collected at the treatment works, disintegrated in a Waring blender and divided into two parts. One part was sterilized by autoclaving it, and the other part was not autoclaved. The portion not autoclaved was tested to

determine its pH and total and coliform bacteria counts at 20° and 37°C at the end of 24 and 48 hrs. When determining the total bacteria counts, tripticaseoy agar was used, and when testing for coliform organisms, eosin methylene-blue agar and brilliant-green lactose bile broth were used. The unautoclaved sewage was thoroughly mixed and was divided into 8 portions. At the end of 1, 2, 3, 4, 5, 10, 15 and 20 days, the BOD and the above-mentioned tests were made.

The autoclaved sewage was tested for sterility and was divided into 3 parts. Each was inoculated with a different amount of *E. coli* concentrated culture, which was indol and methyl-red positive and Voges-Proskauer and citrate negative. The amount of culture added to each of the 3 parts was as follows: 0.1, 0.2 or 0.4 ml. Each of the 3 inoculated sewages was then divided into 8 portions and kept in a constant temperature room at 20°C. At the end of 1, 2, 3, 4, 5, 10, 15 and 20 days the BOD, pH and *E. coli* were de-



● FIGURE 1. Curves show B.O.D. of unautoclaved sewage and of autoclaved sewage with various inoculations of *E. coli*.



terminated at the end of 24 and 48 hrs. when incubated at 20° and 37° C.

The results of analysis are given in Figures 1 and 2. At the end of 10 days the BOD of the unautoclaved sewage was 118 mg/L and that of the inoculated autoclaved sewage varied from 86 to 108 mg/L with an average of 96 mg/L. At the end of 20 days the BOD of the unautoclaved sewage was 188 mg/L and that of the inoculated autoclaved sewage varied from 124 to 164 mg/L with an average of 147 mg/L. The BOD curve for the unautoclaved sewage was typical of domestic sewage. For the first 10-day period the rate of increase of the BOD decreased with time, during which period the carbonaceous materials were undoubtedly being oxidized. After about the tenth day the rate of increase of the BOD became greater, which condition indicated that nitrogenous oxidation was occurring. From the fifteenth to the twentieth day there was no further increase in the BOD.

The equation for a unimolecular reaction,

$$y = L(1 - 10^{-kt}),$$

gives a good approximation of the relationship of the oxidation of the carbonaceous matter in sewage with time, where y represents the oxygen used up at any time t and L is the total oxygen demand. The rate at which the oxygen demand is exerted, k was found to be 0.26 and 0.07 in the case of the unautoclaved and the inoculated autoclaved sewages, respectively, as determined by the method of calculation of Moore *et al* (3).

The BOD of the inoculated autoclaved sewage never equaled that of the unautoclaved sewage. At the end of 10 and 20 days the average BOD values of the inoculated autoclaved sewage were 18.6 and 21.8 percent respectively, less than those of the unautoclaved sewage. The higher BOD of the unautoclaved sewage was undoubtedly due to the presence of organisms capable of oxidizing the organic matter. Probably these organisms were not in the autoclaved sewage. For example the marked rate of increase of the BOD of the unautoclaved sewage immediately after the tenth day indicated the presence of nitrifying organisms.

A study of the number of bacteria in the two sewages is of interest. The total bacteria count (20°C after

● FIGURE 2. Bacteria count in unautoclaved sewage and autoclaved sewage that has been inoculated with *E. coli*.

48 hr.) of the unautoclaved sewage increased from 5,230,000 per ml. at the beginning of the test to 12,000,000 per ml. at the end of 3 days and then decreased to 1,930,000 per ml. at the end of 20 days. In contrast to this high count the *E. coli* (20°C after 48 hr.) increased from 250,000 per ml. at the beginning of the test to 1,000,000 per ml. at the end of one day and then decreased to 175 per ml. at the end of 20 days. The low *E. coli* count at the end of the test was possibly due to bacteriophage or other inimical organisms.

The number of *E. coli* added to the autoclaved sewage apparently had little bearing on the BOD obtained. The 20°C, 48 hr. counts at the end of 20 days, ranging from 13,000,000 to 54,000,000 per ml., were quite high.

Conclusions

The 20-day BOD of the unautoclaved sewage was about 28 percent higher than the BOD of the autoclaved sewage inoculated with *E. coli*. The greater BOD was undoubtedly due to the presence of organisms in the unautoclaved sewage that were capable of oxidizing organic matter which the *E. coli* in the autoclaved sewage could not attack.

It may prove that the BOD of autoclaved sewage, when inoculated with *E. coli*, could be of special interest in studying the carbonaceous content of a sewage, since the oxygen uptake is not masked by nitrifying organisms.

Acknowledgments

The sewage plant is under the general direction of Bernard L. Werner, Director of Public Works, to which Dr. Abel Wolman is consultant. R. J. Trautman, principal engineer, has general supervision over the plant and Paul L. Smith is the plant superintendent.

References

1. Butterfield, C. T., Purdy, W. C. and Theriault, E. J., "The Influence of the Plankton on the Biochemical Oxidation of Organic Matter." *Public Health Reports*, 46, 393 (Feb. 20, 1931).
2. Butterfield, C. T., and Wattie, Elsie, "Observations on the Effect of Variations in the Initial Numbers of Bacteria and of the Dispersion of Sludge Flocs on the Course of Oxidation of Organic Material by Bacteria in Pure Culture." *Sewage Works Jour.*, 10, 5, 815 (1938).
3. Moore, E. W., Thomas, Jr., H. A. and Snow, W. B., "Simplified Method for Analysis of B. O. D. Data." *Sewage and Industrial Wastes*, 22, 10, 1343 (1950).



● VISUAL check by Malcolm Kinney, superintendent, through inspection port in one of the three automatic valveless gravity filters at New Hyde Park water works.

AUTOMATIC VALVELESS FILTERS *Treat Water for Hyde Park*

ANY COMMUNITY with an actual or potential water shortage has lots of worries—and lots of company. A few years ago, the little community of Hyde Park, N. Y., faced this problem—highlighted by the chance that a major fire could be especially disastrous if it occurred at a time of low water. The small plant on Crum Elbow Creek, which used pressure filters to treat creek water, became inadequate when average consumption rose to 100,000 gpd with summer peak demands above 200,000 gpd.

There were three possible ways of increasing the supply. A new filter plant could be constructed to take water from the Hudson River. This, however, would have been expen-

sive due to the high pumping head; the long transmission line that would have to be constructed; and the relatively heavy pollution of the Hudson River requiring a filter plant that would be expensive to construct and to operate. As a second possibility, the present dry-weather supply from Crum Elbow Creek could be augmented by constructing a dam and reservoir above the filter plant. A third possibility was to drill wells some three miles east of Hyde Park.

The Hyde Park Fire and Water District is governed by a Board of Trustees of which J. R. Golden is the chairman. These Trustees called in James C. Harding, who had acted as consultant to the district on water supply matters for some 30 years.

Mr. Harding recommended that, for reasons of economy, the existing plant be modernized and its capacity increased; that the creek be continued as primary source with a well or wells as supplementary or standby water sources. It was also decided that the new plant be as automatic as practical in order to make most efficient use of a two-man staff with numerous duties outside the plant.

Following Mr. Harding's recommendations, two 24-inch gravel-packed wells 30 feet deep were drilled about 1½ miles from the plant, at a point where seismograph tests indicated shallow wells would deliver an adequate quantity of water. One of the wells, with present pumping facilities, delivers approximately 300 gpm. Increased pumping capacity could bring output of the well supply to 500 gpm. However, this well supply developed east of the village had the disadvantage of delivering a water relatively high in iron and manganese. It would have been difficult to construct a filtration plant at the well site as there would have been no way of disposing of the wash water. The well supply was, therefore, designed so that the water could be treated with sodium hexametaphosphate and chlorine and pumped directly into the mains; or, if this was not satisfactory, could be pumped into Crum Elbow Creek and treated at the proposed new filter plant which was designed to treat either creek water, well water, or a combination of both.

Crum Elbow Creek, in the new system, remains the major source of water for Hyde Park; in fact, since the new plant went into operation in March, 1959, there has been no need to tap the alternate well supply since drought conditions have not occurred and there has fortunately been no major emergency demand. Normal flow rate of the stream is a low of 500 gpm and high of 10,000 gpm. Normal raw-water condition of the creek is: Turbidity, less than 5 ppm; color, 20-40 ppm; hardness, 4-5 grains (well water is about 8); pH, 7.8; alkalinity, 85 ppm. Turbidity and color are reduced to 0, pH to 6.7, and alkalinity to 55 ppm. Coliform group density is held at less than 2.2 MPN.

New Treatment Plant

The new plant at Hyde Park has a potential of more than 750,000 gallons per day and can be described generally as a rapid filtration type. Major pieces of equipment in the new plant are a 90,000-gallon steel settling basin, and three automatic

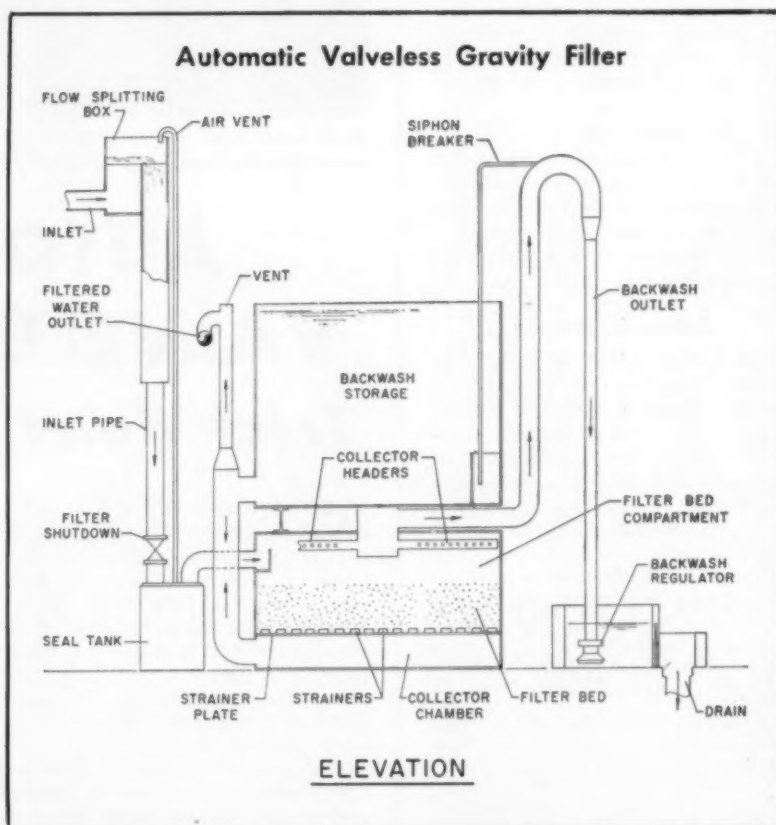
valveless gravity filters, designed and fabricated by the Permutit Company. These filters are arranged in parallel and have a rated output of 156 gpm each.

The automatic valveless gravity filters operate without the use of valves or other mechanical equipment. When filter head loss reaches a predetermined level, set by the design, a siphon is primed and the filter is automatically shifted into the backwash cycle. At the end of the backwash period, the siphon is broken and the filter is automatically returned to the filtering operation. The first water filtered in the new cycle is stored for the next backwash before it places itself back "on-line." A simple interlock prevents any filter backwashing until all others are back in service.

Although the Permutit automatic valveless gravity filter offered interesting and desirable possibilities in plant automation, an important consideration in Mr. Harding's selection of this equipment was the fact that the valveless filters store their own backwash water. This reduced the initial installation cost by

eliminating the need for an extra storage tank and associated backwash equipment. During nearly two years of operation Plant Superintendent Malcolm Kinney has found yet another advantage: Only 0.75 percent (three-quarters of one percent) of the system flow is used for backwashing. The former filters, which were of the pressure type, used six percent. Backwash under the old system also took the plant off service for as much as 45 minutes and a backwash often resulted in lowering pressure in some part of the service system.

Water is drawn from the creek by a pair of low-lift pumps. Alum, carbon and pre-chlorination dosages are applied before the water enters the settling basin. After passing through the gravity filters, the water is post-chlorinated and polyphosphate is added for corrosion control. From the clearwell tank the water is pumped by a pair of high-lift pumps to the elevated storage tanks on the hilltop which have a capacity of 375,000 gallons and which feed into the distribution system.



● IN OPERATION, water passes through the filter and rises to fill the backwash storage tank before overflowing to the filtered water outlet. As the pressure loss through the filter increases, unfiltered water rises in the backwash pipe at right until it fills the siphon and triggers the backwash cycle. Filtered backwash water then discharges upward through the filter bed compartment and collector headers.

BALTIMORE BELTWAY



IS YEARS AHEAD OF OLD SCHEDULE

WILLIAM F. HALLSTEAD

WITHIN little more than a year, motorists will be able to circle three quarters of Baltimore City at an uninterrupted 60 mph. The 33-mile circumferential Beltway is now slated for completion in the summer of 1962, to the pleasant surprise of the area's drivers.

A scant year ago, estimated completion was being projected into the 1970s — 10 years distant. The Maryland State Roads Commission was critically handicapped by the completion requirements of the original 12-year highway building program passed in 1953. This program was divided into three 4-year segments, and 90 percent of each 4-year segment in a given county had to be completed before the construction of the next 4-year segment could be undertaken. Thus any portion of a county's 4-year program could—and did—hold up progress on ensuing construction.

In 1960, the Maryland General Assembly passed a bill revising the 12-year program to permit completion of a continuous system of arterial roads, such as the Beltway, within a 5-year period.

The Beltway was conceived and its plans initially developed in 1953. By the end of 1958, 7.6 of its 33 miles were completed in short uncon-

nected segments which irritated natives and baffled out-of-town drivers. Until the 1960 legislative revision was passed, the Road Commission intended—not without misgivings—to continue construction on the individual segment basis.

Following the vitally important 1960 revision, Commission Chairman-Director John B. Funk appointed a 3-man Beltway coordinating group: David H. Fisher, chief engineer, as chairman; Walter C. Hopkins, deputy chief engineer, in charge of Beltway engineering details; and Sidney Ward, right-of-way executive, in charge of Beltway right-of-way acquisition.

Formation of the coordinating group was announced in May, 1960, and at that time the estimated Beltway completion date was set at the end of 1962. A subsequent acceleration in Federal allotments enabled the Commission to advertise all Beltway contracts before the end of 1960. As a result, the entire Beltway is expected to be open to traffic by mid-summer of 1962.

The \$70-million project will save motorists an estimated \$500,000 a month in reduced operating costs compared to pre-Beltway driving to and from the same points. The saving in time will also be substantial. The Beltway will ring Baltimore like three quarters of a wheel rim beginning at the Governor Ritchie

Highway, main route to Annapolis, on the south, moving northwest to tie into the Baltimore-Washington Expressway, the Harbor Tunnel Thruway, Route 40 West, the main highways to Frederick and Reisters-town northwest of the city, the Baltimore-Harrisburg Expressway on the north, U.S. Route 1 northeast of Baltimore, and terminating under the present program at Route 40 East, the main highway to Wilmington and Philadelphia.

The foregoing are the most important tie-ins in an ultimate total of 35 interchanges in the 33-mile length of the Beltway. Including interchanges and all other crossings, the construction requires a total of 67 bridges.

The motorist will utilize the Beltway as a circumferential by-pass of congested points, riding the rim of the city's metropolitan area until he reaches his desired point of access to Baltimore City or point of egress from the metropolitan area.

The Beltway is designated as Interstate 695 from the Harbor Tunnel Thruway to Route 40 East. From the Ritchie Highway to the tunnel approach it is a state highway. This latter portion, some 3¼ miles, lies within Anne Arundel County. The remainder of the Beltway is entirely within Baltimore County. Despite its name, the Baltimore Beltway at no point enters the city itself.

The Beltway's typical section consists of two 12-ft. lanes of 9-in. reinforced concrete in each direction separated by a 54-ft. grassed median. The pavement is bounded along the outside lanes by 10-ft. stabilized shoulders. Speed limits are 60 mph for cars; 55 mph for trucks.

Anticipated traffic during the first full year of operation is 20,000 vehicles per day. This estimate is well substantiated by the present traffic flow along the already completed 8-mile portion of the Beltway between the Ritchie Highway and Route 40 West. Current traffic counts in this

section stand at 18,000 vehicles per day.

The Beltway speed-up has implemented an innovation in contractor coordination. At least once a month, all contractors on the project meet with Chairman-Director Funk, Mr. Fisher and other Commission construction personnel. The primary purpose of these regularly scheduled meetings is to mitigate the diverse problems attendant to the complex construction.

On December 8, 1960, the first Beltway project to be completed under the new speed-up program was opened to traffic. The 0.8-mile section between the Glen Burnie By-Pass and the Ritchie Highway provided motorists with a dual connection between southwest Baltimore and the area south of the Brooklyn-Curtis Bay region. The bids on the \$388,000 contract had been opened just 7 months before.

With completion of present plans well within grasp, thought is now being given to the possibility of making the Beltway a "perfect circle" around Baltimore City. The southern end of the route, now at the Ritchie Highway, can be extended some 3 miles eastward to the harbor's west shore at Hawkin's Point. In turn, the eastern end of the Beltway, now at Route 40 East, may be extended some 7 miles southward to Sollers Point on the harbor's eastern shore. To connect these new termini, another harbor vehicular tunnel is being contemplated—but authorities state that actual construction of such a tunnel is years in the future.

In the meantime, the city will be virtually ringed by high speed dual highways upon completion of the presently planned 33-mile Beltway length. The motorist simply departs the Beltway at the Harbor tunnel Thruway interchange on the west, travels through the tunnel and departs the tunnel system at Route 40 East; 3½ miles further east, he returns to the Beltway, the short trip along Route 40 being the only portion of his trip not on controlled-access highway, although Route 40 is dualized in that area.

When the Northeastern Expressway is completed between the Route 40 East-Tunnel Thruway interchange and the Beltway, the entire city of Baltimore will be circled by connected controlled-access high speed expressways. This fast-changing region will thus be equipped a decade ahead of previous scheduling to become an integral part of the vast Boston-to-Washington eastern corridor Megalopolis.



Courtesy Baltimore Evening Sun

● ALINEMENT of Baltimore Beltway. Project completion is scheduled for 1962.



Photos courtesy Md. State Roads Comm.

● IDENTIFICATION sign used to inform motorists of the accelerated Beltway construction program. Portions of Beltway already accommodate 18,000 vehicles per day.

INCINERATOR and Sewage Treatment Plant WORK TOGETHER

B. B. REILLY
Chief Development Engineer,
Dravo Corporation,
Pittsburgh, Pennsylvania

EARLY in 1959 Whitmarsh Township, Pa., a suburb of Philadelphia, placed in operation an unusual municipal incinerator. Designed and built by Dravo Corporation, Pittsburgh, with Glace & Glace, Inc., of Harrisburg, as consulting engineers, it was the nation's first incinerator employing the horizontal flow-through principle. (See **PUBLIC WORKS** for February, 1960.)

The incinerator is situated adjacent to the sewage treatment plant of the Whitmarsh Sewer District, and is so designed that the two facilities are complementary. Excess heat developed from refuse combustion makes it possible to burn raw sludge from the treatment plant at high temperatures, while effluent water is used for cooling the incinerator furnace walls and for scrubbing the incinerator stack gases.

The sewage treatment plant includes grit separation, primary settling, trickling filters, secondary clarification and chlorination facilities and a sludge holding tank. Conspicuously absent is sludge digestion. Undigested sludge is pumped from the holding tank to vacuum filters in the incinerator building where it is dewatered. The resulting sludge cake is mechanically mixed with refuse before it is burned. The incinerator includes oscillating storage conveyors, which also serve to mix the sludge and refuse, and facilities for automatically charging raw material into the furnace and removing burned out residue. Water cooling tubes are embedded in the refractory furnace walls so that wall temperatures are maintained below the slagging point of refuse ash. Furnace gases pass through banks of water sprays and then pass up-

ward through impingement type scrubbers where solid particles are wetted and washed out. By the time the gases reach the stacks their temperature has been lowered to approximately 200°F.

Since the sewage treatment plant serves only part of the territory served by the incinerator there is considerably more refuse than sewage sludge cake. At design load the breakdown is 12 tons per hour of refuse and ½ ton of sludge. Thus, even though the sludge cake is 75 percent water, only ¾ of a ton of moisture is added to the charge, resulting in a total moisture increase of 3 percent. In actual practice, the ratio has frequently been varied by storing sludge for several days and then operating the filters at higher rates.

An accurate log was maintained of refuse and sewage sludge incineration rates over a week-long period for performance test purposes. This occurred in late September, 1960, shortly after Hurricane Donna visited the Whitmarsh area so that adverse rather than ideal operating conditions existed.

Normal suburban cleanup activity in the Fall, supplemented by storm breakage, produced an extremely high percentage of hedge, bush, tree and grass cuttings in the refuse. Also, excess sewage sludge was accumulated in the holding tank due to incinerator plant interruption at the time of the storm.

The following summary data has been extracted from the performance test:

Interval: Five operating days,
September 22-28.

Total Refuse Burned: 381.4 tons

Total Sludge Burned: 32.0 tons

Total hours operated: 31.5

Combustible material not
destroyed: 4.36%

Particulate matter in stack
gas: 0.0572 lb./1000 lb. of gas
or 0.0305 grains per std. cu. ft.
of gas.

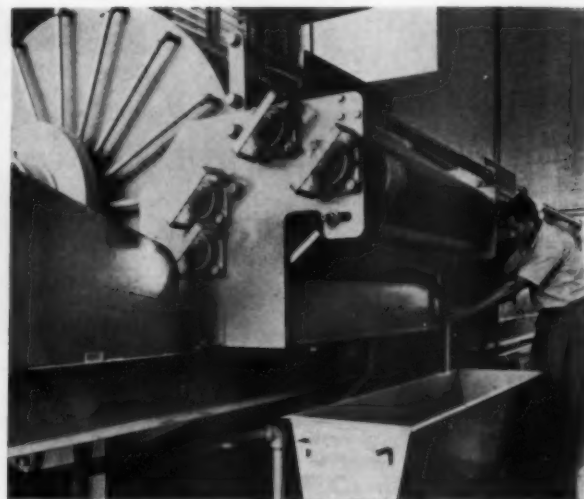
From the above it may be noted that in spite of unfavorable refuse conditions, the plant successfully operated at about double the sludge-to-refuse ratio which had been anticipated.



● INCINERATOR is adjacent to sewage treatment plant, right, and the two facilities are complementary. Sewage sludge is dewatered and combined with the refuse.



● **OSCILLATING** storage conveyors, each with a capacity of 50 tons per day, help mix the refuse and sludge for burning.



● **UNDIGESTED** sludge is dewatered in this vacuum filter to about 75% moisture, mixed with the refuse and incinerated.

Operation to date indicates that the basic plant concept, though new, is sound. Some details and arrangements have required modification to suit practical operating conditions or to simplify maintenance.

One incinerator problem which required early attention was that of burnback of very dry refuse in the charging chute. Synchronization of the furnace gate with the feeder mechanism to compress the material in the chute between charges solved this problem.

Forced circulation of water in the furnace water wall was found to be critical at low flow. Consequently, the original concept of throttling water flow to match the furnace heat absorption was abandoned in favor of continued maximum flow regardless of heat pick-up. A recirculating cycle was adapted to provide for the high flow at all times. This problem appeared to be caused in part by the fact that the water walls are operated at slightly above atmospheric pressure and steam pockets occur easily at low flow rates.

A serious maintenance problem which was recently eliminated concerned the arresting of water droplets which become air-borne above the scrubber impingement tray due to the violent, boiling type action which occurs at this point. A bed of ceramic saddles about 6 inches deep was originally provided to eliminate the water droplets. After several months of operation, these saddles became plugged with the solids deposited by the droplets. Repeated flushing with high pressure water streams failed to give more than temporary relief because the saddles tended to prevent pene-

tration flow beyond the surface layer. Rotary vanes which centrifuge the moisture droplets were installed in place of the saddles to solve this problem.

In the newly installed sewer system, a high proportion of mud in the sewage sludge had to be con-

tended with during the past year as new connections were tied into the system. While the non-combustible mud presents some problems for the incinerator, these problems are not insolvable and are not as severe as comparable mud loading of digesters.

HOW GOOD STREET LIGHTS BENEFIT A CITY

Portions of a paper by BEN WEST, Mayor, Nashville, Tennessee, before the Street Lighting Conference, Atlanta Electrical League, Atlanta, Ga.

NASHVILLE has 423.7 miles of streets lighted with 11,279 mercury-vapor and incandescent luminaires. This averages 265 lamps per mile, spaced 200 feet apart over the entire city. The cost has been \$2.4 million and it is worth every penny of it. The cost per capita annually is less than \$2. Fringe benefits have also resulted. I believe I had some personal benefits out of Nashville street lighting program over and beyond those incidental to it. I went into office in 1951 with a small majority of votes; I had to run again in 1955, at which time the street lighting program was almost completed and I was reelected over four opponents, getting more votes than all the others combined. One of the principal reasons for this was the street lights installed under contract with the Nashville Electric Service at cost plus 8 mills per kwh for energy.

In 1952 we had a vehicle registration in Davidson County of 99,061.

We had 29 traffic fatalities that year inside the city limits—21 of these people being killed during the hours of darkness. Last year with a vehicle registration of 161,780 there were 19 fatalities in 18 accidents; eight of these were killed at night. There were 6,860 accidents inside the city boundaries in 1960; only 1,835 of these accidents occurred at nighttime on city streets.

Nashville has seen fit to oppose requests from insurance rating bureaus for rate increases in liability insurance. One of the strongest arguments we make in opposition to these requests is that, due to our lighting, the accident ratio per car or vehicle is decreasing. There is a real fringe benefit in these reduced or stationary insurance rates.

According to a special report compiled by the Central Records Division of the Police Department, crimes of armed robbery, robbery, break-ins and other acts of violence have materially decreased since the installation of these lights—as much as 22 percent from 1953 to 1960. Also, bright, safe, shopping districts attract nighttime shoppers and help to create better business.

Planning for Annual HIGHWAY MAINTENANCE

GEORGE J. McCANN
Assistant Supervising Engineer
and
RALPH STELLJES
Engineer of Special Assignments
New Jersey State Highway Department

WITHIN the New Jersey State Highway Department, maintenance work on streets and highways is divided in two general classifications—ordinary and extraordinary maintenance. Ordinary maintenance includes routine patching of pavement and shoulders, shaping unpaved shoulders, sweeping, removing litter, cleaning drainage facilities and structures, mowing grass, trimming trees, minor bridge repairs, repairing damaged signs, painting segments of traffic lines and replacing deteriorated portions of guard rail.

Extraordinary maintenance includes resurfacing or replacing pavement, surface treating or resurfacing shoulders, adding drainage facilities, extensive repairs to bridges, bulkheads and fenders and painting of traffic lines. In addition to the foregoing there is snow removal and ice control.

Funds for maintenance are a part of the department's overall annual budget request. New Jersey does not enjoy "dedicated funds" as is common in the majority of states. All monies are appropriated annually by the legislature for all state activities from the general fund.

District supervisors annually submit a request for materials to maintain the highways in their district. The quantities are based on a survey of the needs of every section of road in the district plus the experience of the local foreman with the special problems in his section. Materials in this category include bituminous concrete for patching, stone or gravel for shoulders and bituminous materials for many uses.

In addition to materials requested for ordinary maintenance, the supervisors submit a list of projects for special treatment. This listing includes requests for resurfacing or surface treatment on shoulders or pavement, additional drainage, and the replacement of long sections of guard rail. Working with and supplementing the activities of the

supervisors are engineering specialists for pavements and shoulders, drainage and landscaping. Their function is to investigate the needs, not only for the immediate future, but also on a long-term basis.

Scheduling Projects

From the coordinated activities of the supervisors and specialists, a program is developed not only for the budget year but for several years in advance. It is this advance planning that makes possible the preparation of an intelligent annual budget requirement. After the budget is approved and monies are appropriated, work schedules are pre-

pared on the basis of allotments. Currently allotments do not satisfy needs.

A list of resurfacing projects is compiled by the pavement engineer in accordance with priority and easy movement from one job to another. The list is given to the Bureau's material supervisor who supplies the Equipment Bureau with a copy of the list to schedule all equipment necessary to carry out the operations. Throughout the construction season two complete bituminous concrete paving units are usually in operation. The moves of these units are coordinated by the materials supervisor, who arranges with the

MAINTENANCE				CONSTRUCTION		
JOB NUMBER	DATE OF BIDDING	LOCATION	TYPE OF WORK	ESTIMATED COST	DATE OF COMPLETION	REMARKS
FOREMAN	DATE WHEN STARTED					
As of January 1, 1961						
Drainage						
1705-1-77	10-21-56	Route 17-South of Island Ave.	Construct drainage im- provement	4,420.00		Hold For Revision
2023-77	1-15-57	Route 30 Atlantic City	Drainage improvement	2,344.90		Reconstruct and clear for R&D
7029-77	12-20-57	St. 79 Bismarck Baltimore Co.	Construct drainage im- provement	\$1,053.05		
23000-02-70	8-02-60	Rt. 23, Sec. 129 Piquette Twp Berks County	Drainage improvement	\$4,051.50	12-9-60	100%
1070-02-70	8-27-60	Route 101 Princeton State Police Station	Construct drainage im- provement	19,413.90		
33060-02-70	8-27-60	White Horse Av. & Route 33, Barnesville	Construct drainage im- provement	\$4,765.20		
27060-02-70	8-27-60	Rt. 27, Franklin Twp	Construct drainage im- provement	\$1,069.00		
20270-02-70	9-15-60	First Avenue and Route 202	Drainage improvement	\$3,520.00		
73020-01-70	9-15-60	Route 73, bet- ween Palmyra Bridge & Rt. 130	Drainage improvement	\$2,557.50		
23170-77	9-30-60	St. 73, Steep- hill Lane to Clare Road	Slope and drainage improvement	\$7,755.30		
22560-02-70	10-1-60	Route 101, 22, Lafayette Place, Hillsdale	Construct drainage im- provement	\$1,98.30		
79070-77	10-20-60	Route 1-78 Greenwich Twp. Stewartville Road	Construct drainage im- provement	\$1,435.70		

● THIS part of control board shows scheduling of "extraordinary" work projects.



● **CENTERLINE** painting, shown here on East-West Freeway, comprises one of the ordinary but important maintenance jobs.



● **CONTROLLING** weed growth is another job classified as "ordinary." Here a soil sterilant is being used along US #1.

plant that is furnishing the bituminous concrete to have the required tonnage delivered to each location. Arrangements are made with our laboratory to have materials sampled and the necessary inspectors on the job daily. A seasonal schedule is provided and followed unless some emergency arises that will take a unit off schedule for a short time. When the emergency is over, the unit resumes the schedule until completion. Drainage needs are planned and scheduled in a similar manner. Routine landscaping, minor bridge repair and the more intricate types of traffic line painting are performed by the department forces.

Maintenance by Contract

Experience has shown that it is not economically sound to "tool up" for certain operations. These projects are performed by others under an item "Maintenance by Contract." Into this category fall such projects as large bridge painting, chemical spraying for weed control and mass production traffic lines along the edges of pavement. About 10 percent of the annual maintenance budget is expended on maintenance by contract.

Bridges selected for contract painting are grouped by geographic location for bidding. The preparation of specifications usually starts around the first of the year with all paper work completed for receiving bids during late winter. This gives the contractor an early start in the spring and enables him to complete the work before the end of the summer.

The same procedure holds for white traffic lines and roadside weed spraying contracts. Preliminary work for these two items also starts after January first. The Bureau's

supervisor of signs and traffic lines, after a careful study and survey of the state, submits a list of outside edge lines and certain other traffic lines by routes and location points that he believes should be let out for contract. This list is usually sent to the supervising engineer in the Bureau of Maintenance, who after checking the list passes it along to the director and chief engineer of the Division of Maintenance & Operations for further review and approval. Contracts are prepared, estimates established, availability of funds verified and approval given for advertising the work. All contracts are handled in this manner. On the traffic line contract, it is necessary to plan and coordinate this work to prevent interference with resurfacing or surface treatment work. For chemical weed spray work, the same general procedure is followed except that the landscape supervisor submits the recommendations, prepares contracts and coordinates the work.

Another contract item is major bridge repair, generally where bridge decks must be replaced, new lift spans constructed or the bridge practically replaced. The bridges are listed as line items in the budget and, when approved, the bridge engineer is requested to prepare contracts to be advertised for bids. The bridge engineer assigns personnel to carry out all phases necessary to assure that the bridges are advertised for contract and the money committed before the close of the fiscal year.

Traffic

Except for emergencies, maintenance operations of all kinds are scheduled to cause minimum interference with traffic. Traffic conditions are studied carefully, particu-

larly in the major metropolitan areas where it is frequently necessary to delay the daily start of operations until about 9:00 a.m. and stop about 2:30 or 3:00 p.m. This type of planning is very important in resurfacing operations or placing traffic lines where the work is entirely on the main pavement.

From the carefully analyzed requests of the supervisors and the work schedules previously established, all quantities of needed materials are established. Materials used in maintenance work conform to the department's Standard Specifications. Purchasing is done through the State Purchasing Department, the low bidders supplying materials for given areas. Materials are tested for conformance to specifications by the department laboratory.

Equipment is continually evaluated to determine deficiencies, performance, need of maintenance and repair. When equipment replacement is needed, specifications for purchase are carefully reviewed to insure the benefit of operational experience. In addition to replacement items, a list of new equipment essential to carry out the maintenance program and to maintain the new roads constructed during the year is prepared. Such equipment includes trucks, front-end loaders, snowplows, abrasive or salt-spreaders and mowers. When requesting new equipment in the budget, it is necessary to show justification for its purchase. Under each item of proposed new equipment, an explanation states briefly why the equipment is needed.

Operators are responsible for routine equipment maintenance such as greasing, cleaning, checking oil and tires. When repairs are needed this is reported to the nearest department garage. Traveling mechanics

make field repairs as are necessary. Major repairs are normally made in department garages. The Equipment Bureau maintains records for every piece of equipment and can accurately estimate costs of operation, when major repairs will be needed and economical life.

Administrative Control

The responsibility of administrative control procedures, records, reports, etc. rests with the bureau head who sets up all procedures and allots funds to each section in the bureau. The bureau head receives statements periodically from the accounting division showing what money has already been spent, what has been committed to date, and the balance left in principal line item accounts such as materials, maintenance by contract, and equipment rental. Such statements are excellent guidelines, prevent overcommitment of funds and eliminate loss of funds through lack of planning a work program.

A chart showing the current progress of all extraordinary work is maintained. Included are such items as resurfacing, surface treatments and construction work performed by the maintenance forces. This chart shows the route and job number, the type of work and the estimated costs. Starting and completion dates are inserted opposite each job as they occur. Another chart, showing the status of personnel in the bureau and positions manned vs. vacancies, is maintained weekly.

Work orders are drawn up for everything but routine maintenance after verification that funds are available to do the work. After approval, the work order goes to the superintendent of road maintenance who has jurisdiction over the road maintenance crews that will perform the operation. Purchase orders for materials are coordinated by the supervisor of materials who maintains records and copies of all requests and purchase orders for materials. As material is received by the foreman in the field, he submits a receiving record to headquarters together with the field copy of the signed purchase order certifying that the material has been received. The supervisor of materials has the responsibility of preparing all requests for materials and grouping them for bidding.

Our staff and field forces execute their responsibilities with enthusiasm and full recognition that the traveling public depends upon the job done by them.

ORGANIZATION of a Traffic Engineering Department

*Bernard L. Marsh, Village Manager
for the Village of Skokie, Illinois, pre-
sented this paper at the 1961 Illinois
Highway and Traffic Conference.*

THE VILLAGE of Skokie does not have a traffic engineering department. It has an engineering department, under the direction of a traffic engineer, which has the responsibility for all fields of engineering activity. There were three reasons why a traffic engineer was chosen to head the engineering department. First, it is functionally logical for a municipal engineering agency to be dominated by traffic engineering thinking. After all, municipal engineering is concerned with design, construction, and preservation of physical facilities, primarily streets and appurtenances provided for transportation. It follows then that, if engineering should be performed with the ultimate purpose in mind, designs should be reviewed by a traffic engineer.

It seems to me that if traffic engineering were as old as other branches of engineering, and if the automobile had occupied as prominent a place in our society fifty years ago as today, then most of our municipal engineering departments would already have been oriented toward traffic engineering. Traffic engineering is a subordinate rather than dominant unit of municipal engineering only because of tradition. Traffic engineering is the "Johnny come lately" in the family of engineering disciplines.

The second reason why it is logical to appoint a traffic engineer to head an engineering department is that traffic engineers are specialists in the overall profession. They are men who have usually mastered civil engineering before taking traffic training. It is my feeling that the average traffic engineer is more qualified for administrative responsibility than the average civil engineer. For one thing, he is better able to promote good public rela-

tions. He works with people all the time.

The third reason why a traffic engineer was chosen, in this particular case, is that of the two men being finally considered for the position, the traffic engineer was the best qualified. He exhibited important abilities in public relations, organization, and techniques of direction. Problems of administration reach beyond the physical considerations which are dealt with by most engineers.

There is a division of opinion on the size that a city should attain before it needs to employ a professional traffic engineer. I do not know what size this should be, but I do know that a city of 60,000 people should have one. I do not believe a city of this size can afford separate traffic engineering and general engineering departments. Smaller cities probably must combine all engineering skills in one man (a very difficult thing to do). Skokie found it possible to employ two professional engineers, but had to confine itself to a single engineering staff. Our engineering aides double as rodmen, transitmen, traffic counters, and draftsmen. Our department consists of the director and an assistant director who is a skilled civil engineer; an engineering aide No. 1; two engineering aides No. 2, and a secretary. We have a drafting room, three offices and one vehicle. The professionals are paid about \$10,000 per year each, and the cost of operating the department is approximately \$45,000 per year, (or \$54,000 if we go by the budget request for the new fiscal year).

Several basic decisions were made in the process of achieving our present arrangement. All engineering services had previously been provided on a contract basis, by consultants. An analysis of costs for these services over the previous three years revealed that these costs reached \$68,000 in one year, and averaged \$44,000. The services pur-



● INTERSECTION of a major traffic artery, a secondary street and a residential street, recently channelized and relighted, with volume density signal control.

chased were for original design and construction supervision only. There was no traffic engineering, no public works planning, no routine engineering services, and no continuing engineering advice to our planning bodies.

The first decision to be made by our village council involved a choice between continuing the existing arrangement, or establishing a staff of full-time employees. The second decision was an administrative one involving the choice between creating a separate department or establishing engineering as a division of public works. The third decision called for the choice mentioned, between a traffic engineer and a municipal engineer, to direct the new department.

The obtaining of legislative approval to hire our own engineering personnel was a near thing. Ultimately it involved a split decision by the Board of Trustees, with the mayor breaking the tie. The consulting firm had been with the village about twenty years. Their relations with the village were very good. There was concern that the cost of an engineering department would fall upon the General Fund, and consequently require additional taxation. It was feared that the General Fund could not recover engineering expenses from Motor Fuel Tax Fund, although the consulting services were almost entirely supported from this source. The need for traffic engineering services was acknowledged, but the Board of Trustees also foresaw tax increases to support this. It was feared that an administrative department would

represent a continuing expense which could not be terminated or reduced, as could consulting services. Some members of the Board hoped that all physical improvements would some day be completed, and there would be no further need for engineering. Finally, there is a possibility that political considerations may have had some bearing.

A series of reports were made on the subject, by myself, analyzing first the cost of the existing system, next the deficiencies of engineering services under it, and lastly the organization, physical equipping, and cost of the proposed department. After some nine months of deliberation, the Board of Trustees authorized the creation of an engineering department in October, 1960.

It was my conclusion that engineering services could best be provided in a separate department rather than as a division of public works. This is not a conclusion that should apply to all cities. In Skokie the director of public works is a veteran of 27 years with the village. He is a highly qualified man in the service, maintenance and operational fields of public works. However, he is not an engineer. It did not seem logical to make a professional engineer responsible to him. Conversely, it would have been a difficult adjustment to place a professional engineer in charge of the department, and dilute his professional energies with the responsibility for directing the multitudinous activities of public works. These considerations pointed to a separate department as the best choice. One

argument against creating new departments, however, is the danger of increasing the span of administrative attention beyond the capabilities of the chief administrator. In Skokie the creation of a new department would only increase the span of attention from six to seven department heads, and this did not seem to be unreasonable.

The first step in implementing the organization of a department was to provide a budget for it. This was done at the beginning of the fiscal year—May 1, 1960. When approval was given in October, Paul C. Box, a traffic engineer trained at Yale Bureau of Highway Traffic, was appointed.

There were misgivings about the domination of the department by a traffic engineering discipline in the minds of some members of the Board of Trustees, but they seem to have been dispelled during the months the department has been working. In this short period, the engineering department has proved to be remarkably successful. Not only are all new construction projects being designed and planned in this office, but the department conducts numerous investigations on zoning matters, traffic complaints, and parking problems. All traffic accident reports are analyzed and accident studies have been set up for every major intersection in the village. The department is developing a long-range capital improvement program which includes such items as a priority list of intersections to be signalized, modernization of all traffic signs and a complete new street lighting system. Of the municipal officials who opposed the creation of the department or had reservations about the appointment of a traffic engineer as director, there are probably none who would eliminate the department today. A recent report indicates that we can anticipate revenue from fees which will be earned by the department during the coming year in excess of \$73,000. These include fees from subdividers, from special assessments and from other funds.

The engineering department appears to have justified itself in every way in our administrative structure. It costs no more to operate than the old system, it earns more than it spends, and it represents a tremendous increase in engineering service. It is my opinion that this administrative change was the most significant and fruitful that has been carried out in the Village of Skokie since the adoption of the council-manager plan in 1957.

UNIQUE SURVEY CONTROL SYSTEM IMPROVES URBAN MAPPING

KURT W. BAUER

Chief, Current Planning Section,
City of Madison, Wisconsin

PROPER PLANNING and engineering of municipal public works projects requires constant attention to two factors—the land itself with its topography and physical characteristics and the boundaries of real property ownership. Full information concerning these two factors is essential if municipal public works projects are to be soundly and effectively planned and executed.

Base maps, of required accuracy and precision, providing this necessary inventory of the physical facts relating to the land and its ownership are lacking for many, if not for most, small and medium size cities and villages as well as for some of the larger cities in the country. City engineers, upon whom the primary responsibility for providing accurate base maps of urban areas should rest, have by and large neglected this important responsibility and given little thought to the basic concepts and considerations involved. Indeed, many "city maps" hardly deserve to be dignified by this term, being no more than sketch compilations of paper records.

City planners in particular have cause to be justly critical of the manner in which city engineers have defaulted on their responsibility to provide good maps of our expanding urban areas. Often the available maps have been so poor as to make definitive planning very difficult and costly, and plan implementation through mapping impossible.

The fact that topographic maps of urban areas and their environs are currently being compiled at an unprecedented rate by photogrammetric methods makes it imperative that municipal engineers and planners be concerned with the needs and concepts involved. Relatively simple changes in the specifications governing photogrammetric mapping operations could make these maps the truly effective planning and engineering tools they ought to be and could save much needless duplication of survey efforts at a later date. Photogrammetric en-

gineers, too, should become aware of the fact that the most effective mapping of urban areas may require some changes in their manner of operation.

It is axiomatic that any accurate mapping project requires the establishment of a basic system of horizontal control. This control consists of a framework of points whose horizontal positions and interrelationships have been accurately established by field surveys and to which the map details are adjusted and against which they may be checked. The control system used should be carefully designed to fit the specific needs of the particular mapping project being undertaken.

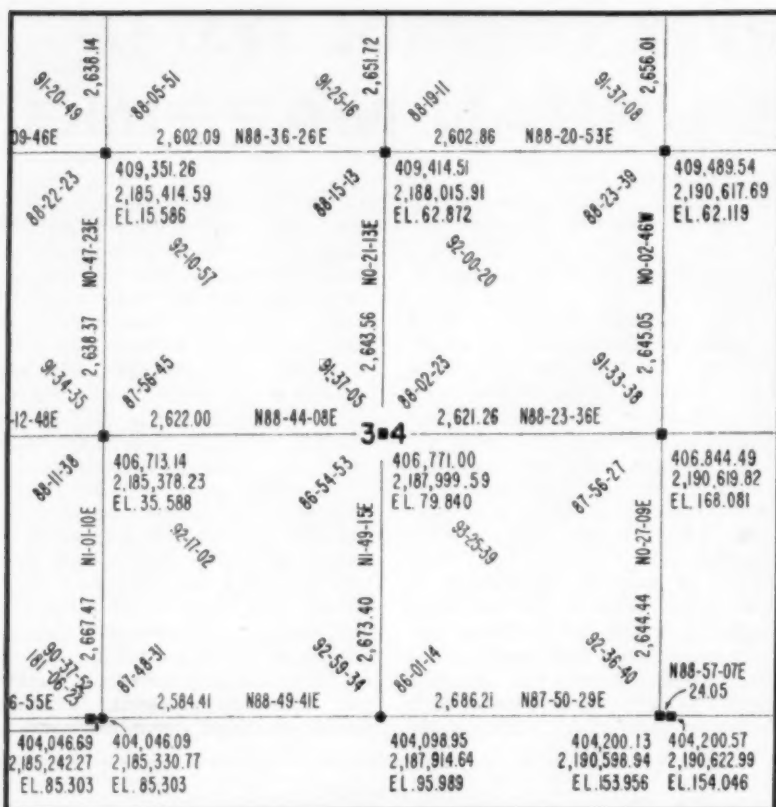
In urban areas it is essential that this control net meet two basic design criteria if the maps based upon it are to be effective planning and

engineering tools. First, it must permit the accurate correlation of property boundary information with topographic data. Most photogrammetrically-compiled topographic maps do not meet this criteria. Second, the control net must be permanently monumented on the ground so that the lines on the map may be accurately re-established in the field when planned public works projects reach the construction stage. That is to say, for urban purposes the control system must be such as to provide finished maps which accurately reflect both topographic and cadastral field conditions and the lines of which can be readily and accurately reproduced upon the ground.

The broad city survey suggested by standard engineering manuals and texts, based upon a permanent-

CITY OF MADISON	
RECORD OF CONTROL SURVEY STATION	
Section Corner	24 24
Township	8 N
Range	9 E
Or Bench Mark No. _____ in 1/4 of Sec. __, T. __ N., R. __ E.	
DANE COUNTY, WISCONSIN	
SET BY: ALSTER & ASSOCIATES, INC., 1960	
STATE PLANE COORDINATES	North 421,830.64
	East 2,167,477.36
	Elevation 12.36
HORIZONTAL DATUM: Wisconsin State System of Plane Coordinates	
Lambert Projection - South Zone	
VERTICAL DATUM: City of Madison	
HORIZONTAL & VERTICAL CONTROL ACCURACY: Second Order	
LOCATION SKETCH:	
DETAILED DESCRIPTION:	
<p>To reach the corner from the intersection of Sherman Avenue and Wheeler Road, proceed west on Wheeler Road for 1/2 mile and a road to the right; then north for 1/2 mile to a brick farm house on the right and the monument as shown above, a concrete monument with a bronze cap.</p>	

● SINGLE sheet gives complete record of survey with details of how to find corner.



● FINISHED control survey diagram shows coordinates, elevations and bearings.

ly monumented first order triangulation and/or traverse net tied to the national geodetic datum and which establishes by supplemental surveys the geographic positions of all street boundary line points, undoubtedly represents the best engineering practice. Unfortunately, few communities are willing to incur the cost of such a survey.

Much new topographic mapping in urban areas is based upon third order control nets having, at best, temporarily monumented stations. These control nets are usually largely unrecoverable and unusable by local engineers and surveyors. These control nets are generally tied to the national geodetic datum and the finished maps compiled on a state plane coordinate grid. Property boundary line maps are, on the other hand, most often mere compilations of paper records, no real framework of control being utilized in the construction at all. Accurate correlation of such cadastral maps with topographic maps and even with other cadastral maps is therefore manifestly impossible.

The City of Madison, having entered a period of rapid growth both in population and area and finding itself largely without the basic maps necessary to enable its plan-

ning and engineering departments properly to cope with this rapid growth, has undertaken an extensive mapping program covering approximately 42 square miles of rapidly urbanizing area. The specifications governing the work required that photogrammetrically-compiled topographic maps be furnished to National Map Accuracy Standards at a scale of 1 in. equals 100 ft. with a vertical contour interval of 2 ft.

In order that these maps be truly effective planning and engineering tools, the specifications required that they employ a unique system of horizontal control based upon the U. S. Public Land Survey System as well as upon the national geodetic datum. The control system devised for the Madison work requires the relocation and permanent monumentation of all section and quartersection corners (including the center of sections) within the area to be mapped and the utilization of these corners as stations in a second order* traverse net tied

*Maximum error of closure before adjustment: horizontal distance or position: 1 part in 10,000; azimuth: 4 seconds of arc per main station; all field methods, computations and adjustments follow U. S. C. and G. S. methods.

to the national geodetic datum through the Wisconsin State Plane Coordinate System. The control traverse net thus establishes the exact lengths and bearings of all quarter section lines as well as the geographic positions (state plane coordinates) of the public land survey corners themselves and provides the basic horizontal control net for the topographic mapping.

Technical Requirements

The specifications governing the work require that the monuments placed to mark the relocated public land survey corners consist of pre-cast reinforced concrete monuments, 4-in. square and 30-in. long, having an embossed bronze cap imbedded in the top. The bronze caps are stamped with the corner notation (quarter section, town and range) as well as with a second order bench mark elevation to city datum.** The monuments placed are referenced by ties to at least three witness marks. The specifications require that the survey engineer provide a dossier on each control station established in order to permit its ready recovery and use. The dossier sheets are on 8½ by 11 in. tracing paper and provide for each station: A sketch showing the monument erected in relation to the salient features of the immediate vicinity; all witness monuments together with their ties; the coordinates of the corner and its Public Land Survey description; and the bench mark elevation of the monument. These dossier sheets are recorded with the county surveyor and are thereby made available to all land surveyors in the metropolitan area.

The control survey data is summarized by means of a control diagram at a scale of 1 in. equals 1,000 ft. showing: The exact length and grid bearing of the exterior boundaries of each quarter section; all monuments erected; the number of degrees, minutes and seconds in the interior angles of each quarter section; the state plane coordinates of all quarter section corners together with their Public Land Survey System identification; the bench mark elevations of all monuments set; the exact lengths and grid bearings of all survey connections to basic U. S. C. and G. S. control sta-

**All level circuits for basic vertical control are specified as second order; error of closure not to exceed 0.035 times the square root of the total length of the level circuit expressed in miles; all circuits to be adjusted by U. S. C. and G. S. methods.



● PORTION of finished property boundary line map. Note that property lines are tied precisely to state plane coordinate system, making accurate correlation possible.

tions together with the coordinates of these stations; and map sheet outlines.

The finished topographic maps, in addition to showing the usual contour information, spot elevations, planimetric and hydrographic detail and coordinate grid ticks show, in their correct position and orientation, all quarter section lines and corners established in the field surveys. The angle between geodetic and grid bearing is noted on each sheet as are the combination sea level and scale reduction factor and the equation between City of Madison Datum and mean sea level.

All the work necessary to execute the control surveys and provide the finished topographic maps is being done on a negotiated contract basis with Alster and Associates, Inc. of Washington, D. C. In this regard it is essential to retain a photogrammetric and control survey engineer completely familiar with first and second order field methods and procedures and crews properly equipped with up-to-date survey instruments. Two Tellurometers and a Geodimeter were employed in the Madison work as well as several Wild T-2 optically reading

theodolites and a Zeiss automatic level. Indeed, the control net devised is made economically feasible only through the application of these recently developed instruments, particularly the electronic distance measuring devices. Although the specifications governing the Madison work make the photogrammetric engineer responsible for overall supervision and control of the mapping work, as well as for the quality of the finished maps, they require that the actual relocation of the Public Land Survey corners be done by a local land surveyor employed as a sub-contractor by the photogrammetric engineer. The specifications thereby recognize that this portion of the work requires expert knowledge of local survey custom and boundary and title law, as well as the assembly and careful analysis of all authoritative survey information such as title documents, subdivision plats, survey records, existing monumentation and occupation, in order to arrive at the best possible determination of the location of the land survey corners. In the Madison area the land survey portion of the control survey work required a very high degree of pro-

fessional competence as almost all of the Public Land Survey Corners fell under the federal definition of either obliterated or lost corners. The importance of this phase of the work and its impact on property boundaries throughout the community can hardly be overemphasized.

Actual property boundary line maps, complementing the topographic maps, are being compiled by the city itself. These maps are being compiled at a scale of 1 in. equals 100 ft. on sheets 30-in. square, each sheet covering a quarter section. The maps show: Grid bearings and lengths of all quarter section lines; the state plane coordinates of all quarter section corners and the monument marking these corners; the dimensions of all street lines, alley lines, and boundaries of public property; street widths; and platted lot dimensions. In unplatted areas, real property boundaries are shown by scale alone. Principal structures and lake and stream shore lines are also shown. The property boundary lines are compiled by reconstructing on the drawing board all existing plats and deed descriptions within the limits of each quarter section, utilizing the new lengths and bearings of the quarter section lines as control.

Compilation of the property boundary maps in this manner permits their reduction on a 10 to 1 ratio for the compilation of an accurate wall map at a final scale of 1 in. equals 1,000 ft. by mosaic process. A 2 to 1 ratio is used for compilation of neighborhood unit maps for planning and systems engineering purposes. Contour information is readily and accurately transferable from the topographic maps by a simple overlay process.

Advantages of Control System

The unique system of horizontal control utilized in Madison's current mapping project has important advantages over the control systems usually utilized for such work. It provides a consistent and accurate system of control for real property boundary line surveying and mapping as well as for topographic mapping. Since the boundaries of the original government land subdivision form the basis for all subsequent property divisions and boundaries, the accurate re-establishment of the quarter section lines and corners permits the compilation of property boundary line maps and the compilation by the usual photogrammetric methods of topographic maps.

(Continued on page 184)

Force Account Construction and Direct Purchases by Water and Sewerage Utilities

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Water and Sewerage Industry
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MORE THAN 13 percent of the construction of public water utilities and about 5 percent of the construction of public sewerage facilities are performed by force-account, based on annual averages for the years 1952-59. Direct purchases of materials and equipment for use in force-account construction of water and sewerage utilities represented an annual average of approximately 7 percent and 1.5 percent, respectively, of total construction expenditures for materials and equipment during the same period.

These figures represent relatively small proportions of the total volume of construction and of materials and equipment expenditures for water and sewerage facilities, but when expressed in terms of dollars they are quite impressive. The value of force-account construction of water utilities amounted to \$134 million in 1959; that of sewerage facilities, \$42 million. In both cases, the amounts are almost double the 1952 figure. Direct purchases rose in dollar value from \$29 million to \$66 million for water facilities and from \$6 million to \$8 million for sewerage facilities, increases of 128 and 33 percent, respectively.

These estimates, based on a recent study by the Water and Sewerage Industry and Utilities Division, BDSA, will be of interest to suppliers and manufacturers of materials and equipment in the water and sewerage fields, many of whom may be unaware of the market potentialities created by force-account construction.

Basis And Scope of Study

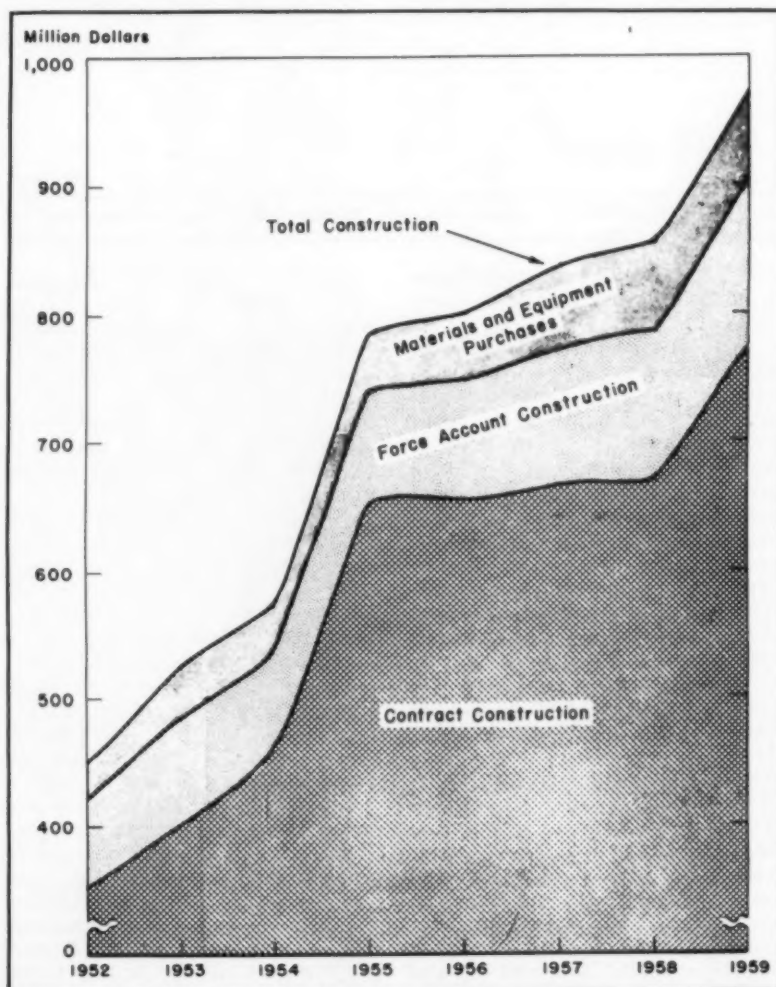
The 1952 Census of Governments assembled data on the "Capital Outlay" of the publicly owned water and sanitation facilities with "Sewers and Sewage Disposal" separated for only the municipalities

of 250,000 population or more. These data on total capital outlay were broken down into (1) contract construction; (2) force-account construction; (3) direct purchases of materials and equipment (most of which were incorporated into construction); and (4) purchases of land or existing buildings.

Contract construction costs in most cases are about 50 percent materials and equipment expenditures. Force account construction includes also about 50 percent for materials and equipment. Direct purchases of materials and equip-

ment include purchases that go into inventory for immediate or later use in contract or force-account construction. Purchases of land or existing buildings were not included as part of the construction.

By 1956 more extensive data were assembled on sewers and sewage disposal separately from other sanitation for cities, townships, counties and special districts. The 1957 Census of Governments then obtained complete data on capital outlay of all local governments, separately identifying water and sewerage utilities.



● **WATER UTILITIES**—estimated volume of construction, 1952-1959. Force account construction has remained relatively constant, averaging 13.8 percent of the total.

Using these data and estimating or interpolating the missing items it was possible to prepare realistic estimates of the percentage of the total capital outlay (excluding the purchase of land and existing buildings) represented by (1) contract construction; (2) force-account construction; and (3) purchases of materials and equipment for the years 1952-1959, inclusive. For the period 1942-1951 the lack of sufficient data precluded reliable estimates; and even if data were available it is believed that the war years 1942-1946 were non-typical and therefore of little value in establishing the normal patterns.

These percentage patterns for each year were applied to the estimated construction volume put in place for water and sewerage utilities to indicate construction practice in recent years.

To account for the construction performed by privately owned

utilities and by real estate developers, 20 percent was added to the publicly owned water utility volumes and 10 percent to the publicly owned sewerage utility volumes.

Water Utilities

The estimates developed for publicly owned water utility construction show force-account construction varying as a percentage of capital outlay from 15.4 percent in 1952 and 15.9 percent in 1953 down to 10.5 percent in 1955. Force-account construction rose again to 13.8 percent in 1958 and 1959. The average for the period for all water utilities was 13.4 percent of capital outlay for force-account construction. In estimated dollar value the volume indicates an increase from \$69 million in 1952 to \$134 million in 1959.

The 1957 Census survey shows that townships, counties and special districts expended 16.3 percent of

their total capital outlay for force-account construction, and all municipalities 12.2 percent. However, municipalities with population over 25,000 and therefore larger staffs, devoted 17.7 percent to force-account as against 4.0 percent for municipalities under 25,000.

Further breakdown reveals that in the total capital outlay for water utilities, 14.2 percent was expended by townships, counties and special districts while all municipalities represented 85.8 percent. Municipalities with population over 25,000 represented 51.5 percent of total capital outlays, and municipalities with population under 25,000 represented 34.3 percent.

In all force-account construction the special groups performed 18.2 percent and all municipalities performed 81.8 percent. Municipalities of over 25,000 population accounted for 71.2 percent of total force-account construction, and municipalities with less than 25,000 population expended 10.6 percent.

Contract water utility construction was divided into 12.8 percent for special groups, and for all municipalities 87.2 percent (48.9 percent for the over 25,000 population group and 38.3 percent for under 25,000).

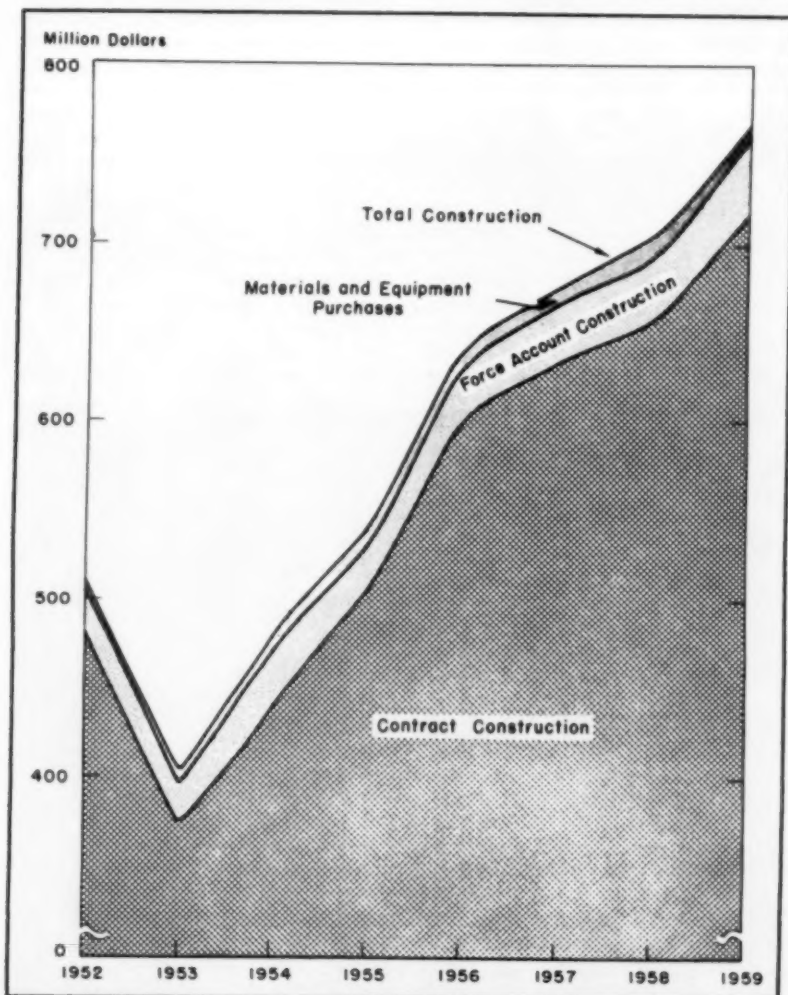
For materials and equipment purchases, 22.0 percent was spent by the special groups, and 78.0 percent for all municipalities including 45.8 percent spent by the over 25,000 population group and 32.2 percent for the under 25,000 population group.

Sewerage Utilities

The estimates developed for sewerage utilities construction show force-account construction varying from 4.7 percent of total capital outlay in 1952 up to 6.2 percent in 1954, dropping to 4.7 percent in 1955 then rising to 5.5 percent in 1959. The average for force-account construction for the period for all sewerage utilities is 5.2 percent of total capital outlay. In estimated dollar value the volume indicates an increase from \$24 million in 1952 to \$42 million in 1959.

Again using the 1957 Census survey, townships, counties, and special districts expended 5.1 percent of their total capital outlay for force-account construction, and all municipalities 4.7 percent. As for water utilities, municipalities with population over 25,000 exceeded those with less than 25,000 population, 5.8 percent as compared to 2.5 percent.

(Continued on page 166)



● SEWERAGE UTILITIES—estimated volume of construction, 1952-1959. Volume of force account construction averages 5.5 percent of total performed in this field.

ROADSIDE DEVELOPMENT ON OHIO INTERSTATE ROUTES

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Ohio Department of Highways,
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THE HIGHWAY landscape architect needs to have a working knowledge of the principles of highway design, the mechanics of road construction and the problems of maintenance. He must be fully aware of the extent that this knowledge can be applied to a well balanced highway so that the roadsides blend with and become a part of the surrounding landscape. The landscape architect deals with the living elements of highways.

In Ohio, the soils within the right-of-way, because of the cuts and fills, are much different than those found on the adjacent farm lands and a thorough knowledge of soils is necessary. The greater percentage of the roadside areas will be in turf so the selection of grass seed, fertilizers, and mulches which are best suited to the area, soil, exposure, and general climatic condition is of great importance. A closely knit sod will lower maintenance costs by helping to prevent the deposition of eroded earth in highway ditches, stop gullying, permit the stabilization of shoulder soils and prevent the blocking or undermining of culverts.

Highways designed as separate one-way roads may better fit into the landscape. Flexibility and a pleasing, free-flowing alignment of widely separated roads, often at different levels, effectively avoids monotony and resultant driver fatigue. Such a design can take advantage of natural topography and landscape features, such as a stream and rock outcroppings, and permits the conservation of existing plant material, generally resulting in a reduction of costs. Wider medians, in turn, lead to the reduction of the hazards of glare from oncoming headlights, head-on collisions and U-turns, and may also reduce construction and maintenance costs.

The Ohio roadside is an important factor to the community through which it passes and is designed to

blend into the surrounding environment. It should also be functional, easy to maintain and should provide safety, utility, economy, and beauty.

Curves and grades effect sight distance and safe operations. Flattened slopes and a well-rounded cross section encourage vegetative growth, reduce the problems of scalping, lessen snow drifting, prevent soil erosion, and permit easy operation of maintenance equipment. Rounded and warped slopes provide a smooth transition into the existing topography and reduce artificial uniformity.

Clearing and grubbing operations provide for the conservation of desirable existing plant material to preserve natural effects. Selective thinning is done to open views into the offscape. Trees are left to create an informal design pattern giving an irregular skyline and low growing trees and shrubs offer an undulating effect. Weak, over-mature, or damaged trees and those obstructing a view are removed. From a practical standpoint, the conservation of existing plant material within the

roadside areas reduces the need for new material and tends to keep down costs. The introduction of other plant material serves a functional purpose, but must be of the native variety to tie in with existing species.

Trees can screen an objectionable view, may be used to accentuate road alignment changes or as living snow fences and always serve to highlight the natural beauty of the roadside view. Ohio's Interstate highway will carry heavy traffic which presents problems of noise and fumes in urban and suburban sections. Plantings help to insulate adjacent residential areas, schools, motels, and other properties from the fumes and noise of traffic. Trees have another function to help balance the carbon dioxide automobiles and trucks discharge in the air. An ample right-of-way with existing and planted trees well back from the pavement also promotes safety and lessens the chance of serious accidents if the motorist must leave the highway in an emergency. Trees can do much to relieve the monotony of driving over long stretches



● LOCATED to take advantage of the existing stands of timber as natural back-grounds, these roadside rest areas are an important part of the complete highway.

of highway by introducing variety and interest in roadside and skyline scenery.

There are two ways that land adjacent to the right-of-way can be acquired by the State of Ohio. One is the Rural Scenic Easement which, in effect, is "an interest in or servi-

tude over agricultural land adjoining the parkway under which the owner surrenders his right to change the manner of use of his land." Such an easement would not permit the State to enter upon the land for any purpose without the owner's permission. The owner could continue

to cultivate the land and use it for pasture or other normal farming pursuits but could not erect billboards or change the manner of use.

The other means by which adjoining scenic land can be acquired is covered in the Bureau of Public Roads Memorandum Number 126 dated June 21, 1941, and titled, "Use of Federal funds for the purchase of land adjacent to highway right-of-way for the preservation of the natural beauty through which highways are constructed." This memorandum states, "Section 11 of Federal Highway Act of 1940 among other things, permits a limited percent of the Federal aid funds, apportioned to and matched by any state to be used without matching for the purchase of such strips of land of limited width adjacent to highway right-of-way as may be approved by the Bureau of Public Roads." It is a means to preserve small portions of the vanishing native landscape—small but important ones because they are seen by all.

Landscape architects realize that developing highways today to serve the public in a complete manner entails not only the safe movement of vehicles, but also the safe stopping and parking of vehicles off the travel way. Much of the travel on Ohio's Interstate highways is expected to be of the long-haul type. The monotony, eyestrain, and fatigue of constant driving justify the need for occasional, well-located, well-designed places where the motorist can stop safely for rest and recuperation. Safety rest areas are recognized as fulfilling this highway need. They are located back of the normal right-of-way line to eliminate possible parking on the berm and to encourage travelers to drive into the park and use the parking area provided for them. Our rest areas include water, restroom and picnic facilities for motorists and provide "Travel Tips" which give information concerning road conditions, the location of service facilities, and scenic, historical, and recreational areas. The information includes the location of service facilities at the next interchange. Telephone service is also available.

The Interstate highway system is being built for future generations to use and enjoy. These roads must be planned with the care and foresight that comes from the full cooperation of the highway engineer and the highway landscape architect—cooperation that starts in the design stage; incorporates utility, safety, beauty and economy; and emerges as a "complete" highway.



● AT AREAS nearest the state borders, manned information centers provide the traveler with advice on road conditions and location of available service facilities.



● SEPARATE paved parking areas will accommodate 35 passenger cars and 12 trucks. Setback from roadway, acceleration and deceleration lanes assure safe use.



● PICNIC TABLES, charcoal grills and shelters are stationed on concrete platforms to minimize maintenance and provide clean comfortable facilities for users.

SOLVING SEWAGE SLUDGE PUMPING PROBLEMS:

SLUDGE WITHDRAWAL SHOULD MATCH THE RATE OF SLUDGE PRODUCTION

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Phoenix, Arizona

THE PROBLEMS encountered with sludge pumping are as numerous and varied as treatment plants. The sanitary engineer assumes that sludge is a fluid that obeys established hydraulic laws except that the hydraulic tables offer very little to rely on. We attempt to characterize sludge by the usual hydraulic tools of specific gravity, viscosity, percentage of solids and friction factors and yet we are dealing with a substance that defies uniformity.

In spite of this, many designs rely on average conditions of uniformity for success. This article does not attempt to develop new hydraulic coefficients, but merely to cite some desirable design features and some operational experiences that have facilitated the job of sludge removal.

Removal of sludge from sedimentation tank hoppers affects the efficiency of the digestion process and the sedimentation process. Our objective, of course, is to attain highest performance from both processes by getting the most sludge we can out of the settling tank hoppers and putting the least water we can into the available digester space.

Undoubtedly, raw primary sludge is the most difficult to handle. Mixtures of raw sludge with waste activated sludge or recirculated final sludge from a trickling filter plant are somewhat easier to handle. Completely digested sludge or activated sludge present the least problems in pumping.

In withdrawing sludge from a primary tank hopper, the initial amount of sludge usually has a high consistency because of compaction in the hopper and the tendency for heavier sludge masses to work toward the bottom. The larger the hopper, generally, the thicker the sludge.

As withdrawal is continued, the consistency lessens and if too much sludge is withdrawn, excessive amounts of water find their way into the digestion system consuming

space in the digester unnecessarily.

The variation in sludge consistency has, of course, an effect on pumping since the initial friction is higher. If the pump suction is connected directly to the settling tank hopper, there is an additional problem. If the initial rate is set high to overcome the initial friction, the sludge in the primary hopper may "funnel" and allow water to be withdrawn, leaving large amounts of sludge on hopper slopes and extremities.

Generally, the lower limit of pumping rates are governed by sludge consistency, as explained above, and another very important factor, namely the piping system. Many engineers have the erroneous idea that the larger the size of sludge piping, the better. The application of this idea and the concept that the 2 fps self flushing velocity for gravity sewers will suffice for sludge piping has fostered much trouble.

Secondary sludge, which normally has a solids range of 0.5 to 2 percent is similar to sewage or water in its hydraulic characteristics. The same cannot be said for primary sludge, however. It has been stated in several references that the velocity of

flow in sludge pipes should be above the critical velocity to avoid clogging and the deposition of grease. The higher the solids content of the sludge, the higher will be its critical velocities.

In general, velocities between 5 and 8 fps are found to be very satisfactory for primary sludge, not the 2 fps that is sometimes used. Some pump manufacturers and designers advocate 3 to 5 fps as a design criterion based on successful experience at plants. The higher the design velocity, the higher will be the operating head and horsepower requirements.

Where the sludge pumps take suction directly from the settling tank hoppers, pumping at 5 fps and higher is looked upon with disfavor because of the likelihood of funnelling water instead of pumping sludge. Possibly for this reason, designers fell into a trap and used 2 fps as a design value, and applied a few safety factors to provide flexibility and to withstand variations and changes in actual conditions.

Engineers solve most big problems by breaking the big one into little ones, so it is obvious that this approach should be taken for the



● AIR VIEW of 91st Avenue sewage treatment plant. Sludge drying beds are at left bottom; digester at top of picture with trickling filter and sedimentation basins.

sludge problem, separating the operation of sludge withdrawal from the problem of pumping to digesters. Some plants are designed and constructed with gravity sludge draw-off into a separate sludge well. Sludge is withdrawn from the primary hoppers individually to the sludge well by means of mud valves, swing pipes or telescoping valves. The well enables pumping rates to be controlled independently of rates of withdrawal from the tank hoppers. Likewise, a means of visual observation of the sludge is provided so that unwanted "water" is prevented from entering the digestion system.

The principal trouble with gravity sludge draw-off is that it is seldom operated correctly, at least with the same mistakes made with a direct pumping system, through no fault of the operators. Starting with the birth of mechanically cleaned sedimentation tanks, operators' manuals and handbooks have contained a set of standard instructions that made the operator full of confidence in running sludge pumps for a half an hour or an hour in the morning and a similar period at night.

One of the fringe benefits obtained from getting thick sludge to the digester is a lesser supernatant problem. The thicker the sludge pumped to the digester, the less supernatant return; likewise, the less supernatant there is to dispose of, the less of a problem there is.

The twice or three times a day pumping habit has compounded the operator's trouble. The longer the period between pumpings, the thicker the sludge is and the harder it is to move. With the slip pipe (or telescoping valve) it is necessary to lower the device to its lowest operating level to get the sludge moving. When the sludge did flow, it gushes out with excess water before it could be brought under control. With direct pumping, similar troubles were experienced.

One obvious way to get the thickest possible sludge out of a sedimentation tank is to schedule sludge withdrawal to match the rate of sludge production. This necessarily does not mean that the operator must spend all his time at the sludge pump, but any time spent will be well worthwhile. After all, in an average plant 25 to 40 percent of the capital investment is used to build the facilities for 0.5 percent of the flow—sludge.

Various methods of matching sludge withdrawal to production can be used. A method found successful at small plants may not be even

adaptable at a large plant where multiple sedimentation tanks are involved.

The Phoenix Plant No. 2 put into operation in October, 1958, and although we have had our problems we are able to draw sludge with an average solids concentration of 6 percent month in and month out. Rarely do daily averages drop below 5 percent and we have had values to 9 percent with no difficulty. For some 13 months before the plant was put into operation, part of the collection system was cut in and we were treating about 0.3 mgd with temporary facilities. The trunk outfall has a maximum capacity of about 12 mgd and during these 13 months solids deposition occurred in the trunk sewers. When the plant was started and the remainder of the drainage area collection cut over, initial flows were about 1.4 mgd which began flushing out the deposited solids.

We have one 95-ft. diameter by 8-ft. SWD center-feed primary clarifier. The primary tank hopper is connected by a pipe and telescoping valve to a separate sludge hopper. It was intended that under normal operation the sludge pumps would take suction from the separate sludge hopper; however, the piping was arranged for flexibility of operation as well as dewatering purposes in that the pump battery could bypass the telescoping valve and sludge pit arrangement and pump from the primary tank hopper directly to the digester.

In the beginning, because of the high concentration of sludge in the clarifier hopper, we were unable to withdraw sludge through the telescoping valve, even with the valve lowered to its maximum possible travel. Drawing sludge from the clarifier hopper directly by pumping was then attempted, but this was likewise unsuccessful. Incidentally, there is 6 ft. of positive suction head on the pumps.

The only way sludge could be moved was to back-purge the primary sludge line with final tank liquor to break loose the material and make it fluid enough for pumping. We had only 12 hours of each day with operating personnel present and for a few months the first pumping of each morning was done directly from the clarifier for a few minutes; then withdrawal was switched over to the telescoping valve. At all other times the sludge was drawn to the well by the telescoping valve without difficulty. To prevent over concentration of sludge in the primary hopper, we found it

necessary to schedule sludge withdrawal and pumping more often than every 2 hours. This was found to be easier in operation, and it was possible to obtain a more concentrated sludge than if we kept the telescoping valve lowered partially all the time. With the latter settling, sludge is continuously withdrawn from the primary tank to the sludge well throughout the operating day. Whenever the sludge well fills, the pump is turned on and the sludge pumped to the digester. This occurs on the average of once every hour. If the telescoping valve is left at the same position all the time, the sludge will accumulate in the primary hopper at a faster rate than it is withdrawn from the primary during periods of high flows. It is necessary manually to adjust the telescoping valve during periods of higher flows to increase the withdrawal rate, otherwise the sludge would get thicker, perhaps stop flowing completely. Manual adjustments of the valve are not necessary more than one or two times a day and these are anticipated from operating experiences.

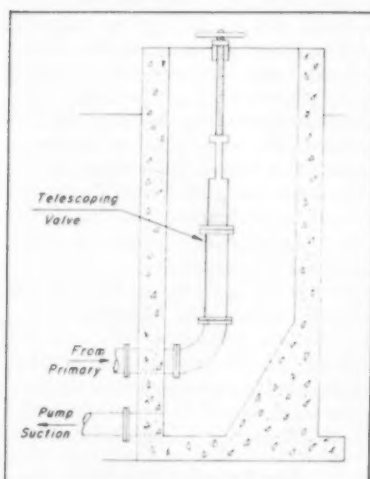
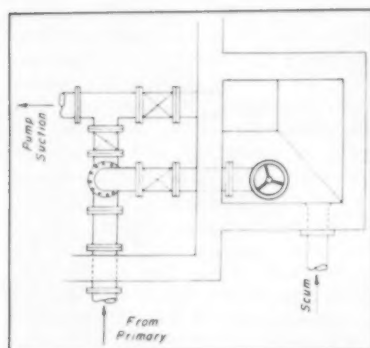
As mentioned above, we are pumping 6 percent sludge, on average, by using a relatively simple routine (with few problems). In the early months our sampling did not include or reflect the heavier concentrations pumped directly, and were considerably heavier than the recorded average of analyses.

Los Angeles Practice

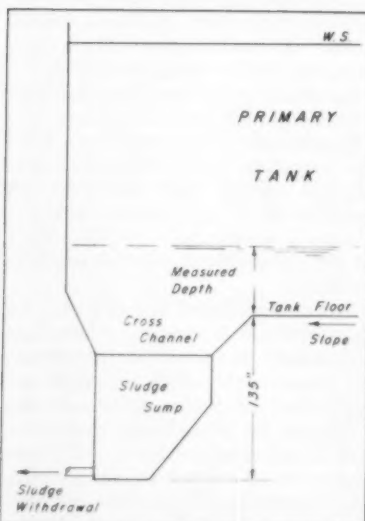
The procedure at Phoenix Plant No. 2 has been developed mostly by self defense and trial and error, and it is interesting to compare our operation with that of the Hyperion Plant at Los Angeles which also matches sludge withdrawal with the rate of sludge production. The studies conducted in July, 1959, at the Hyperion Plant have produced a set of operating rules that have had similar results. This operation has established a correlation between sludge concentration and the depth of the sludge blanket in the primary tanks.

It has been found best to pump for frequent short periods rather than for longer periods less frequently. At present the sludge pumps are controlled by timers which cut the pumps in for a predetermined number of minutes per hour, and these timers are hand set by an operator on the basis of periodic manual measurements of the sludge blanket depth. The method of measurement of the blanket is extremely simple, consisting only of dropping a length

of plastic hose straight through the tank contents and aspirating through this hose by means of a small mechanical ejector. The discharge will markedly change from clear to cloudy



● AT TOP is plan of typical sludge well for one settling tank; just above is section through the same structure.



● SLUDGE at Hyperion plant is withdrawn by sludge pumps controlled by time clocks set for a predetermined cycle.

when the top of the sludge blanket is reached. The blanket depth can be more easily maintained over a narrow range with frequent short pumping periods.

If the blanket level rises, the pumping on-time is increased and vice versa. This experience has indicated that solid concentrations of 6.0 to 6.5 percent are maintained most effectively and easily, and that striving for heavier concentrations is too erratic and uncertain. The work at the Hyperion Plant is continuing in an effort to find a better method of sensing the sludge blanket level.

Another relatively new development in the control of sludge pumping is the continuous density analyzer which utilizes radioisotopes to analyze and to record automatically sludge densities. The original installation of one of these units at Columbus, Ohio, was for the purpose of controlling return activated sludge and met with remarkable success. Later similar units were installed to control primary sludge pumping. The average solids content of the raw sludge has been boosted from 5 to 8 percent and thus has reduced digester loading considerably. Pumping equipment is set to pump a minimum of 6 to 8 percent. When the sludge becomes more dilute than 6 percent, the pump cuts out; a time clock takes over and permits the pump to remain idle 30 minutes. The pump then starts and runs for 5 minutes or if the sludge is not up to 6 percent, the pump cuts out again. Columbus pumps a 24-hr. production of sludge out of 2 tanks in a total of 3 hours pumping time.

The story at Phoenix Plant No. 1, a 30-mgd activated sludge plant, is a different one. This plant has three primary tanks and a battery of three sludge pumps with suction piping directly connected to the settling tank hoppers. Encouraged by the Hyperion success and our own results at plant No. 2, we attempted to improve our operation at the activated sludge plant. Heretofore we had been pumping a 4½ percent primary sludge to the digesters, without the benefit of a closely controlled operation. This pumping facility, however, was plagued with a serious grease clogging problem. Accumulations of grease were so rapid and severe that the discharge piping became completely clogged in the week's time and prevented check valves from closing. The check valves were the internally balanced weighted flap type, and upon inspection proved to be severely corroded. Likewise, some searching of the

plans and an attempt to clean the line revealed several underground bends, elbows and dips that obviously permitted grease problems to develop. The internal working parts of the check valves were removed and the discharge piping was relaid to provide as straight a line as possible.

Pending completion of further improvements to the system, we are able to develop a routine that produced an average 6 percent sludge pumped to the digesters. This was done by controlling the rate of pumping as indicated by a magnetic flowmeter on the main discharge line. We found that pumping rates below 100 gpm and preferably about 75 gpm produced the most concentrated sludge. The three pumps had to be operated one by one and without the benefit of check valves. This procedure requires a great deal of manual operation and almost constant attention.

The installation of new externally balanced check valves and time clocks is under-way.

Based on our experiences, we feel that a 6 percent sludge can be easily had with timeclock operation and that even better results will be forthcoming with a more thorough analysis of our operating conditions.

Additions to the activated sludge plant are under construction. The design incorporates a telescoping valve for each primary and a separate sludge well. Pump suction piping will be arranged so that, if desired, sludge can be pumped directly from the primary. In our opinion, velocities in pump pipelines still is an important factor.

The methods used at Phoenix, the sludge blanket control system used at Hyperion Plant, or the Columbus practice, are surely a step in the right direction but do not as yet appear to be perfection. Certainly, the principle of scheduled sludge withdrawal matching the rate of sludge production is sound. It remains to be seen whether size of plant, strength of sewage, the number and arrangement of plant units, or the treatment process employed will affect the sludge handling techniques.

It seems to us that the ultimate in primary sludge control seems to be an automatic device capable of sensing actual solids concentrations in these primary sludge hoppers; operating in conjunction with a pumping facility that will maintain velocities and hydraulic conditions in pipelines, that will preclude or minimize clogging problems. One of these days handling supernatant liquor may be a thing of the past.

SOILS LABORATORY ASSURES QUALITY CONTROL OF COUNTY ROAD-BUILDING MATERIALS

This article and the accompanying photographs were prepared by Bob Karolevitz, a technical writer from Bellevue, Washington.

A SOILS TESTING laboratory staffed by a graduate chemist and a lab technician gives King County, Washington, continuing quality control of the materials which go into its roads. Established by county road engineer, Walter F. Winters, the laboratory also serves two important secondary functions: 1) Assisting in road design by ascertaining usability of native materials at construction sites, and 2) location of gravel pits, quarries and other material sources within the 2,298 sq. mi. county.

In its primary mission, the King County laboratory uses both commercial testing equipment and some jerry-built apparatus to achieve its goals. With asphalt being the major surfacing material employed on the county's 2,287 miles of roads, testing of the component parts is the lab's main function.

The asphalt binder and rock aggregate are tested throughout the course of a project by running samples of the hot mix through the laboratory (King County uses very little road mix). A Soiltest centrifugal asphalt extractor separates the asphalt from the rock for testing purposes. A penetrometer is used to check asphalt cement qualities. An economy feature of the process is a special chemical recovery apparatus developed by Irvan A. Potter, county materials engineer who directs the lab operation. The device recovers the chemical solvent (trichloroethane) for further test runs.

Testing of the aggregate is done concurrently with asphalt checks. Bulk samples are brought in from the job, dried and divided into testing batches by use of a sample-splitter. If the moisture content of the sample is desired, the lab has a

Stabil-Therm laboratory oven. Primarily, however, a gradation test and a sand equivalent determination provide the information most needed in this phase of the road-building operation.

The laboratory has Tyler standard screen scales ranging from 1½-inch down to .0029 inches for gradation purposes. A mechanical sieve-shaker, built by a road district machinist from spare parts and an old washing machine motor, eliminates much of the physical labor. Using a prepared solution of formalin and glycerine, the lab chemist separates sand from the clay, the latter remaining in suspension. After that it

is a simple matter to measure sand and clay percentages.

On new right-of-way, Potter and his lab technician, Jerry Adair check soil conditions at 50-foot intervals. The auger they use allows them to test to a depth of 17 feet, if necessary. They check for soil makeup, compaction qualities and any other factors necessary to determine suitability for road work.

Laboratory soils equipment includes a liquid limit testing device and a Proctor soil density apparatus. In some King County areas, peat bogs and marshy bottoms create major road-building hurdles and soils testing is vital to the success of the projects.

When asphalt roads are completed, the King County lab takes samples with its 4-inch diamond core drill. These are primarily for density tests, but it is also possible to re-check asphalt content, materials size or even types and thicknesses of base materials used by the contractor.

The lab also is set up to conduct tests of aggregate in concrete work. At present, King County does not have compression testing equipment so this service is obtained commercially.

Other equipment items important to the lab's function include a



● KING COUNTY Road Engineer Walter F. Winters (pointing); left to right are Commissioners Scott Wallace and Ed Munro, Jerry Adair and Commissioner Odell.



● LABORATORY technician Jerry Adair is checking a soil sample. The laboratory carries on a wide range of testing, including soils, asphalt and concrete aggregate.



● TYLER standard screen scales and a mechanical sieve shaker are used to determine the gradation of aggregate.

Magni-Whirl utility water bath, a 4 kg torsion balance, a Temco laboratory hotplate with temperature controls and a pair of propane gas hotplates for non-critical heating and drying.

An additional service provided by the testing laboratory is the regular checking of materials which go into subdivision development projects which will ultimately become county roads. Not only does this assure the county of good quality roads when it takes over, but it is of considerable value to the commercial materials companies.

"Extreme cooperation" is how



● MATERIALS Engineer I. A. Potter conducts sand equivalent test to determine sand and clay content of a sample.

Potter describes his work with these materials suppliers. "They are actually desirous of the service," he says, "because it gives them a continuing test of the materials they are providing and protects them against any future claims." For this purpose, Potter has devised a special form which goes to the supplier following a test; a duplicate is kept in the lab's files.

Actually, King County's lab has paid for itself for several years to come in its secondary prospecting role. King County, like most others, owns considerable property via tax default and other means. This prop-

erty is checked by the lab personnel before it is put up for sale and, as a result, the soils laboratory has prevented the loss of a substantial gravel deposit on property owned by the county which was to be sold at a regular tax-title auction. When time is available, Potter and Adair conduct field explorations for materials at other likely sites. They test the materials thoroughly, estimate quantities available and recommend to the road engineer land that should be acquired.

In setting a precedent for counties in the State of Washington, Winters was faced with the problem of equipping the new laboratory without excessive expenditures. While there was no skimping on the major equipment items, used sinks, hotplates, miscellaneous containers and an asphalt warming oven were acquired by diligent search and at minimal expense.

Potter and Adair are proud of their lab, and the results of their efforts have proved to the county commissioners that quality control in road-building means savings to King County.

• • •

National Water Resources

Copies of the final report of the Senate Select Committee on National Water Resources, Report #29, can be obtained from the U.S. Government Printing Office. This report summarizes studies of the relation of water resources activities in the United States to the national interest, and the extent and character of water resources activities, both governmental and non-governmental, that will be required to take care of needs for water for all purposes between now and 1980.

The report indicates that withdrawals of water, now totalling 300 billion gallons daily, will be doubled by 1980 and tripled by 2000. Tabulations in the report indicate that consumption and on-site uses of water will amount to 23 percent of today's average remaining stream flow by 2000.

The studies indicate that by the year 2000, municipal wastes will require 70-97½ percent removal of BOD with industrial wastes requiring 50-97½ percent removal of BOD to maintain 4 ppm dissolved oxygen content in the streams.

The minimum cost of collection and treatment of municipal and industrial wastes is estimated to \$42 billion between 1954 and 1980, and \$82 billion between 1980 and 2000, a total of \$124 billion.

COMPRESSION JOINTS

Aid Sewer Contractor

A 33,000-foot main trunk line sewer being installed by the Zarubica Company in Orange County, California, will serve Atwood, Yorba, Linda, East Anaheim and portions of Santa Ana Canyon and the city of Placentia. The slope of the line varies from a minimum of 0.14 percent to a maximum of 0.72 percent. The total flow requirement is 15.2 million gallons per day.

The contractor reports high productivity in the installation of the line by the use of clay pipe with factory-made compression joints. Use of these joints has permitted the installation of as much as twice the footage possible with alternate joining methods. Six different sizes of pipe manufactured by Gladding, McBean & Co. and varying from 15 in. to 33 in. are being installed.

The compression joint also adds a safety factor since workmen spend less time in the cut. This is especially helpful in the sandy soil in which the Atwood line is being installed. John N. Jepson, Construction Safety Engineer for the California Division of Industrial Safety states that the present job in Orange County is another example of the excellent safety conditions found on projects constructed by the Zarubica Company.

Another advantage of using the speed-seal compression joint is noted by S.S. Zarubica. He states, "it is possible to run a much tighter operation by using the factory-made joint. Since there is no waiting for a joint to set, backfilling can be done immediately. We are backfilling within one pipe of the pipe-laying crew. This means that we can dig, lay and backfill all at the same time in a small area."

Minimum relocation of dirt and immediate backfilling is important both from the standpoint of economy and public relations within the community. Since a relatively narrow trench is sufficient for installation of the compression joint, digging and repaving costs are reduced. The smaller cut also results in a smaller spoil pile which, coupled with immediate backfilling, means that dirt does not have to be truck-hauled to and from the job.

In the Atwood installation, the dirt is being handled only one time. The dirt is hauled directly from the digger to the backfill area where it is immediately dumped. Only fifteen feet of open trench is left overnight, which results in minimum interference with traffic under maximum safety conditions.

The Atwood project is part of an over-all trunk line development for Districts Two, Seven and Eleven which comprise the western end of Orange County. When completed, it will provide a sanitary system adequate to meet the needs of Orange County, the fastest growing county in the United States.



● IMMEDIATE backfilling reduces the length of trench that must be kept open and also reduces construction costs. This shows how closely backfilling followed laying.



While torque-converter drive is of primary benefit in front-end loader operation, it also gives you the extra power and traction you need for getting your backhoe in and out of muddy conditions like this.

Other important benefits you get as standard equipment with the CASE W-3

- Choice of Case-built 52 hp gasoline or Diesel engine
- Bigger drive tires — 14.9 x 24 6-ply
- 10-ply front tires
- 7000-lb capacity front axle
- Full power steering
- Shuttle transmission
- Backhoe digs 14 ft deep. Swings 180° with exclusive foot control
- 2500-lb lift capacity front end loader with 6000-lb breakout force. 15 cu ft to 1 cu yd bucket
- Self-leveling bucket
- Wide choice of interchangeable attachments including: dozer, grade-blade, pallet-fork, crane-hook, choice of four loader buckets and eight backhoe buckets

Why your next backhoe-loader should have both torque converter and direct drive

Many users of wheel-type backhoe-loaders make the mistake of buying the *lowest priced* rig available — only to discover that it *doesn't* have enough power or traction to handle many of the jobs expected of it. For this reason, you will be money ahead by choosing a higher-output machine, like the Case W-3, that combines the power-boosting benefits of a torque converter, with the speed and economy of direct drive. Here's why!

Travels and works where others can't

Since a torque-converter-equipped tractor provides an *infinite* number of speed ratios — down to 0 mph without stalling — you get a lot more traction, with minimum wheel slippage. Result: With the Case W-3, you can load faster, backfill, climb slippery grades, travel and work through hub-deep mud that would stall ordinary wheel rigs.

Double push-pull power—without clutching or shifting

The diesel or gas-powered Case W-3, with torque converter, gives you *twice* as much push-pull power as the same size conventional rig. In addition, torque output is matched to the load instantly—AUTOMATICALLY—without clutching, shifting, or stalling. This enables you to load-out bigger payloads much faster with the front-end loader... a tremendous time-saver in backfilling, and clean-up operations... an extra money-maker in truck-loading.

Full hydraulic priority... longer life

The converter keeps engine and hydraulic pump running at full effective rpm, without "lugging down". You *always* have full hydraulic power for fast break-out with the loader bucket. The torque converter also gives you longer tractor life since all components are protected against operating shocks by a "cushion" of hydraulic oil.

Drives job-to-job at 19.3 mph

With the Case W-3 loader, or combination backhoe-loader, you get all these proven benefits of torque-converter drive — *plus* a handy lock-out lever that lets you *switch* to direct drive "on-the-go" — for 19.3 mph road travel.

Nets you more profit per dollar of investment

While the Case W-3 costs a few dollars a month more than so-called "economy" diggers, its extra productivity and go-anywhere ability, enable you to handle a *wider range of backhoe-loader jobs at higher net profit*. See your Case Industrial Dealer for convincing proof, or write J. I. Case Co., Dept. G1341, Racine, Wis.

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NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

1961 Congress and Equipment Show Promises Varied, Interesting and Comprehensive Program

"Better Service and Lower Costs Through Research and Development." This is the theme for the 1961 Public Works Congress and Equipment Show to be held at the Municipal Auditorium in Minneapolis September 24-27. In addition to the technical and social program being planned, over 100 exhibitors will have their equipment, materials and supplies on display, allowing public works officials the unique opportunity to compare the relative merits of industry's new products in terms of their individual needs.

An early bird registration will be held at the Minnesota Room of the Leamington (the Headquarters Hotel) from 9 A.M. to 11 A.M. on Sunday, and will continue from 12:00 Noon to 5:00 P.M. on Sunday at the Municipal Auditorium, and from 9 A.M. to 5 P.M. Monday through Wednesday. Sunday afternoon will be devoted to inspection of exhibits and a scenic tour of the Twin Cities with a get-acquainted party in the evening.

For the first time, an APWA Theatre is being planned which will feature new public works movies to be shown at the Leamington. Other special features of the meeting will be the consultation clinics, an ice carnival and the annual banquet with the presentation of awards.

Monday's program will include a series of progress reports on new developments, such as "Traffic Control by Radar, Radio and TV," "City-Wide use of Garbage Grinders," "Recording and Transmission of Water Quality Data," and "Sealing Pavements with Asphalt Slurry." Time will be allotted for discussion groups and the sharing and comparing of ideas. There will also be a workshop on identification of research needs.

On Tuesday's agenda are the APWA Theatre, (to be open Wednesday morning also), consultation clinics, the "National Public Works Week Kick-Off Luncheon," and introduction to the recipients of the Samuel A. Greeley Service Awards for 1961 and a full afternoon of technical papers. Some of the subjects to be discussed are "Street Maintenance Costs," "Proper Planting and Care of Street Trees," "Standardization of Public Construction," "Upgrading Inspection of Public Works," "Modernizing Aging Utility Systems," "Scientific Analysis of Refuse Collection Systems," and the "Management of Street Sanitation Operations."

Wednesday's program will include a workshop on administrative problems, and a panel discussion on metropolitan public works problems. The Congress will come to a close

Wednesday evening with the annual banquet. A full program of activities is also being planned for the ladies in attendance.

Promotional Kits for National Public Works Week Are Now Ready

Chicago, Ill.—Complete kits for the promotion of National Public Works Week have been assembled and are now available upon request. The 1961 observance will be held October 1-7.

This packet of materials, similar to last year's kit, contains a proposed list of activities to be carried out at local levels, sample proclamations to be signed and issued by mayors, radio, TV, and press releases, sample editorials, a fact sheet for speeches, the 1961 National Public Works Week Seal for reproduction purposes, a nomination form for candidates for the "Top Ten Public Works Men-of-the-Year" award and other useful items.

A very important part of the program again this year will be the selection of the "Top Ten" in public works. Nomination forms must be postmarked not later than August 15th. The persons to be selected are those whose work reflects the highest standards of professional conduct for public works officials; and whose achievements are noteworthy in relationship to the manpower and financial resources available. In choosing the "Top Ten" from nominations submitted, the judging

OFFICERS: Frederick W. Crane, Buffalo, N. Y., *President*; Albert G. Wyler, New Orleans, La., *Vice President*. REGIONAL DIRECTORS: (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; Roy W. Morse, Seattle, Wash.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Manon P. Phillips, Augusta, Ga.; Edward J. Booth, Bismarck, N. D.; (term ending 1963) George J. Maher, Lewiston, Maine; Robert S. Hopson, Richmond, Va.; Harlan H. Hester, Fort Worth, Texas. *Immediate Past President*, Jean L. Vincenz, San Diego, California. Robert D. Bugher, *Executive Director*.

committee will take into consideration the different levels of government, the size of jurisdiction, and the various areas of specialization within the public works field. The selection will be made by a judging committee appointed by the President of the Association. Recipients will receive an attractive bronze wall plaque.

Neither the selection of the "Top Ten" nor participation in any other aspect of the National Public Works Week program is restricted to members of the Association. All persons interested in the importance of public works to the community, either directly or indirectly, are urged to consider the inherent potential in such a public education program. The ability of governmental agencies to attract and hold competent people is greatly dependent on the people's attitude toward their public servants. It is hoped that this nationwide program will help in elevating the status of public works engineers and administrators in the eyes of their respective communities and in stimulating greater civic pride in our system of local self government.

Communities participating in last year's program sponsored such activities as parades and displays of

public works equipment, high school essay contests with a \$50 U.S. Government bond to the winner, guided tours to and through public works installations and facilities, dinner speeches by civic leaders, local TV coverage, local showings of public works films, and the use of press and radio to tell the public works story and the vital work that is being done.

Now is the time to start planning. For a complete packet of materials write to the American Public Works Association, 1313 East 60th Street, Chicago 37, Illinois; or to Kiwanis International, 101 East Erie Street, Chicago, Illinois.

APWA Sets Long Range Membership Goal of 25,000

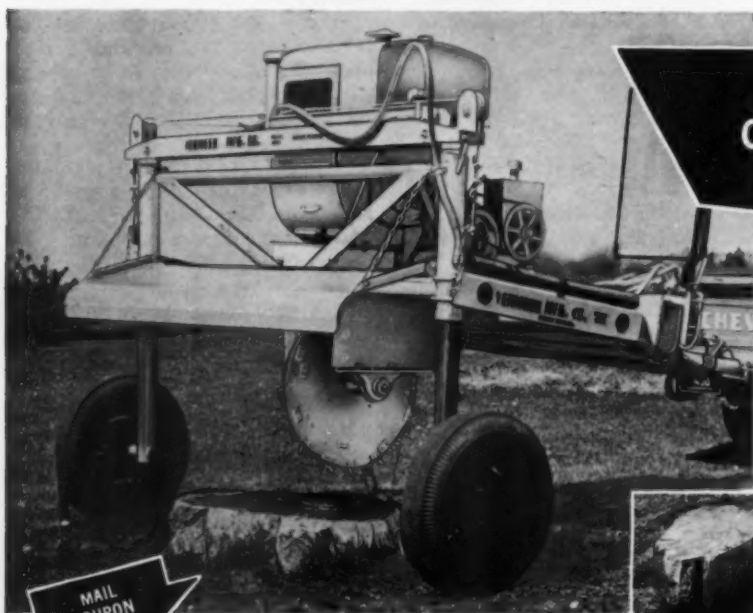
Chicago, Ill.—Upon the request of the Board of Directors of the American Public Works Association, the staff has recently completed a study of the membership potential of the organization. Based on these findings the Association has set up as a long range goal a total membership of 25,000 to be reached in the next 20 years. With a membership of 5,400, and growing at a rate of approximately 12 percent per year a membership of 15,000 is expected by 1970.

The APWA is now engaged in an extensive membership campaign. Over 24,000 officials, involved in some phase of the public works field, received a letter from President Crane calling attention to the Association's outstanding activities and services and to the 1961 Congress to be held in Minneapolis, September 24-27. They also received a newly designed APWA Story brochure outlining the benefits of membership.

The effectiveness of the APWA depends to a degree on increasing the membership not only to secure the fullest possible representation and participation, but also to obtain financial support for the organization's expanding program of activities. Increasing the membership adds to the pool of knowledge, abilities, experience and resources available to members. For information about membership in the APWA write to the headquarters office, 1313 East 60th Street, Chicago 37, Illinois.

New Addition Planned for "1313" Center

Within the next year the American Public Works Association will occupy new offices (within the same building) which will provide



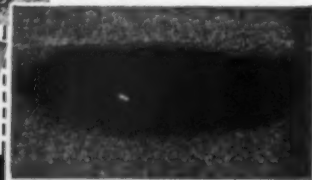
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Original Low Cost VERMEER POW-R-STUMP CUTTER

Rips Stump To Shreds In Minutes!

You'll save hundreds of back-breaking man-hours and thousands of dollars annually... with a Vermeer Pow-R-Stump Cutter. The choice of tree experts everywhere! It's the modern way, the economical way to remove ugly stumps. Mail the coupon for all the details... and a FREE demonstration.

Photos show how big revolving cutting wheel rips stump to chips... down to 10" below the ground. Dirt is replaced, chips removed and area is ready for seed or sod.



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Send complete descriptive literature and prices on your Pow-R-Stump Cutter to

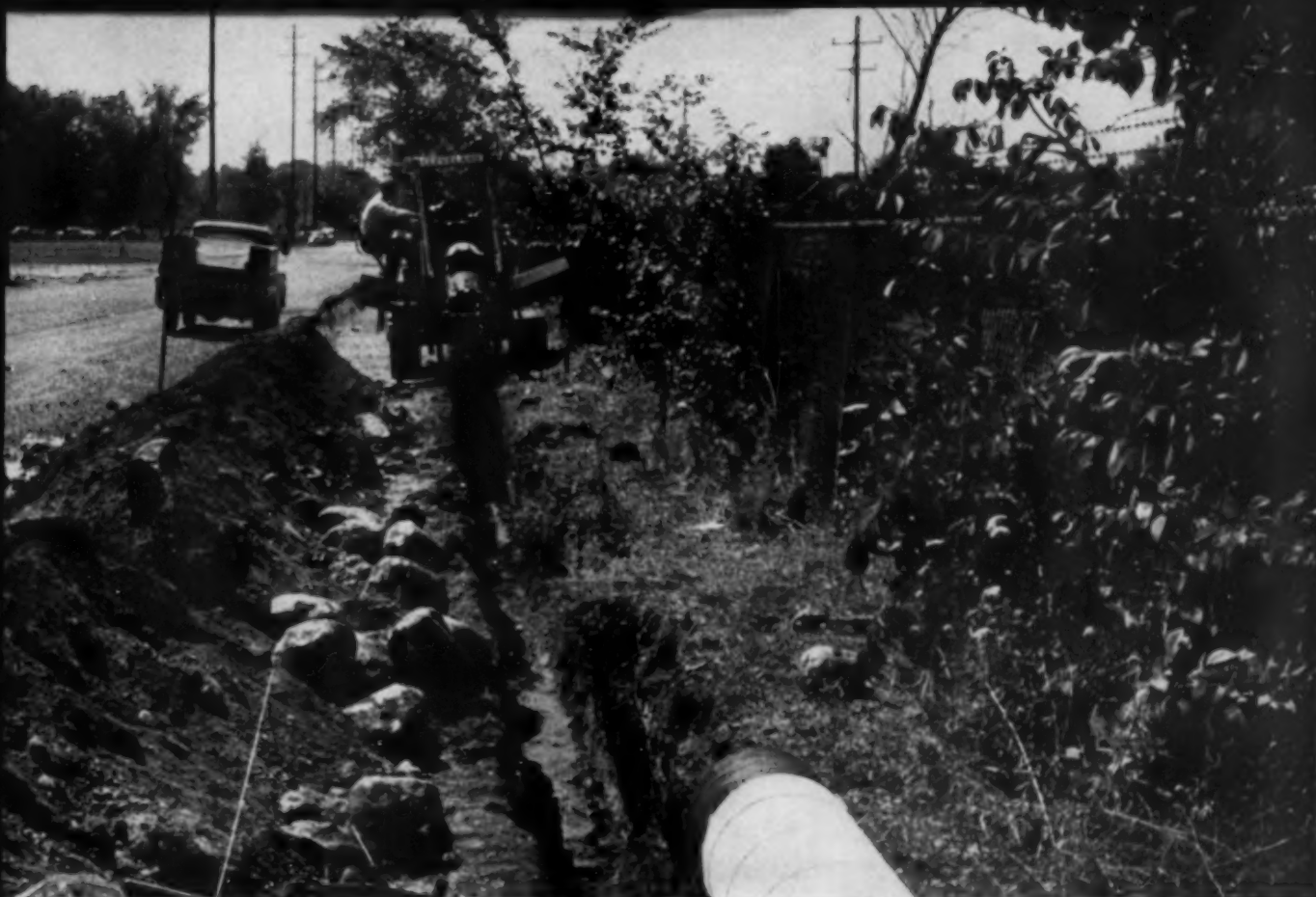
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- 4 digging-wheel speeds, over 30 positive crawler digging speeds—the *right* combination of power and speed for every soil and condition.
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- Conveyor reversal and speeds up to 1,000 FPM with pulley-enclosed, dual hydraulic drive.
- Positive, fast, full-range boom hoist—keeps accurate grade, speeds set-in time around underground obstructions.
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There's a Cleveland J for every type and size of trench, from 13 to 30 inches wide, down to 7 feet deep. Check them now with your distributor.



CLEVELAND TRENCHER

THE CLEVELAND TRENCHER CO., 20100 ST. CLAIR AVE., CLEVELAND 17, OHIO

the additional office space so badly needed by this growing organization. The move will be made possible by a new addition to be added to the Public Administration Center at 1313 East 60th Street, Chicago 37, an address made famous as the headquarters of 22 associations, societies, institutes, and conferences dedicated to improvement of government.

A four-story wing will be added to the Gothic structure expanding the office space for the existing organizations by approximately 50 percent, providing 39 additional offices. Groundbreaking ceremonies

for the new wing got under way May 16th with a number of dignitaries present including Chancellor George Wells Beadle, The University of Chicago, and Louis Brownlow, one of the founders of the "1313" center and a noted journalist and executive in the public administration field. The architect for the addition is Shaw, Metz and Associates of Chicago. The approximate cost is \$750,000.

Upstate New York Chapter Meets

Schenectady, N. Y.—Speaking at the Upstate New York Chapter meeting of the APWA, Dr. Morris

Cohn, editorial director of Water Works Engineering and Wastes Engineering, said that the challenge of public works will be to preserve and improve the central cities in the urban complexes and to make life better in the fringe areas. The three-day meeting was held April 30 through May 2nd at Schenectady, N. Y.

Following a tour of Rotterdam with an inspection of water management and waste control in General Electric Company, the sewage treatment plant, a water pumping station, and a current subdivision development, a luncheon meeting was held with the installation of new officers. Frank Vicaretti, asst. executive director, Department of Public Works, Rochester, was elected president; Lawrence A. Fletcher, assistant director, Department of Public Works, Jamestown, was named vice president; and Joseph J. Dunn, principal engineer, Department of Public Works, Rochester, secretary-treasurer. District Representative Arvid Karkkainen, city engineer, Rochester, officiated at the installation. On the executive committee are: Wallace R. Hagaman, assistant engineer, Bureau of Engineering, Rochester; Allen P. Fulton, commissioner of Public Works, Lockport, New York; Alexander Gray, director, Department of Public Works, Monroe County, and George Kandra, director, Department of Public Works, Batavia.

Speaking on sewage disposal problems in subdivision developments William G. Wilkie, district sanitary engineer, New York State Department of Health discussed the widespread use of septic tanks in subdivisions. He suggested that now is the time to evaluate carefully our present position and take stock of the knowledge we have gained from our experiences of the past 15 years and to insure that the systems are properly installed in accordance with approved plans and that proper construction has been provided.

J. Kenneth Fraser, of J. Kenneth Fraser and Associates, Consulting Engineers, Rensselaer, spoke on "Problems Involved in the Planning, Design, and Financing of Water and Sewage Projects." Other topics included "Recent Developments in the Structural Use of Steel, Timber and Reinforced Concrete," "Recent Developments in Surveying Procedures and Equipment," "Water Management and Waste Control in General Electric Co.," and "Requirements of Good Concrete and Methods of Quality Control."



Superintendent
Ralph Heftmeister
and son Robert quickly
clean sewers at Village of River Hills,
Wisconsin, with FLEXIBLE SeweRodeR
mounted on FC-170 Jeep chassis.

FLEXIBLE SEWERODER for 1961

Now This Village Can Whip Any Sewer Emergency — FAST!

With a population of 1257 and 20 miles of sewer to maintain, the Village of River Hills solved its problems with existing manpower. They chose the Flexible '61 SeweRodeR and have tripled cleaning capacity for preventive maintenance: the crew can clear a stoppage anywhere along the entire 20-mile sewer system in 30 minutes. Village, town or city—"Flexible" has the equipment to solve any sewer cleaning problem FAST and economically.

Contact your Flexible Sales Engineer today.

1961 FEATURES:

- Now more positive rod drive for smoother operation
- Economical 48" rods • 900 ft. reel capacity
- 4 to 4,000 lbs. controllable push-pull power
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P. H. Van Orden, President, C. L. Peterson, Vice-President and Treasurer, and R. H. Webb, Foreman of the Van Orden Company, Contractors, of Grand Rapids, Mich., supervise the installation of "K&M"® Asbestos-Cement Sewer Pipe at Paw Paw, Mich.

10,000 FT. OF SEWER PIPE LAID...

... not enough infiltration to measure

Read how the Van Orden Company solved the problems of installation and of infiltration when pipe had to be laid 9 ft. below the water table.



“



P. H. Van Orden

the ease of handling
and assembly saved us
dollars and time!”

“Construction of the Paw Paw trunk sanitary sewer called for installation of pipe at depths up to 19 feet, where water table was at 10 feet. Infiltration had been the major problem in other sewer installations in the area. We solved this problem by using “K&M” Asbestos-Cement Sewer Pipe with its FLUID-TITE joint. With 10,000 feet of sewer in, we haven’t had enough infiltration to measure.

“The longer laying lengths and the speed with which a joint can be made are definite time-saving factors, which have added to our production. Less time spent grading pipe and handling material means dollars saved.”

Rigorous tests prove “K&M” Asbestos-Cement Sewer Pipe is infiltration-tight at 25 psi . . . a pressure equivalent to that of a 58-foot head of water.

“K&M” Asbestos-Cement Sewer Pipe won’t rust, rot, or corrode. Its smooth bore remains clean, permanently. Flatter grades are possible. Fewer lift stations are required.

Maintenance-wise, the village of Paw Paw, Mich., will enjoy tax savings. “K&M” Asbestos-Cement Sewer Pipe is practically indestructible. Requires fewer inspections, because root growths do not penetrate the exclusive FLUID-TITE coupling.

Write today for more information on “K&M” Asbestos-Cement Sewer Pipe to:
Keasbey & Mattison Company,
Ambler, Pa.



Keasbey & Mattison at Ambler



Two-step assembly! Lubricate the tapered end of “K&M” Asbestos-Cement Sewer Pipe, then slide it into the exclusive, patented “K&M” FLUID-TITE® Coupling.



Light weight reduces shipping and handling costs...saves on installation time. At the same time, there's a minimum of wastage and breakage on the job, with tough “K&M” Asbestos Sewer Pipe.

BRUSH DISPOSAL CREWS OPERATE FULL TIME WITH THE TROUBLE-FREE



CITY

This low-maintenance Fitchburg Chipper is disposing of brush in the City of Holland, Michigan.



UTILITY

"Our men have been particularly pleased with their Fitchburg Chippers . . . they are rugged and reliable."

Rockland Light
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TREE COMPANY

"We have never had one (Fitchburg Chipper) wear out or give excessive trouble." Chipper still operating after 9 years.

Davey Tree Surgery
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San Francisco, Calif.



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"Our Fitchburg Chipper consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower."

Dept. of Public Works
State of Rhode Island

When crews go out to trim trees, it's costly to have machine breakdown. That's why foresters, park superintendents, line clearing supervisors, and tree companies prefer the Fitchburg Chipper. This well-engineered brush chipper is designed for busy, trouble-free service, no down-time.

The rugged Fitchburg Chipper requires little upkeep, and has low maintenance cost. It's economical to operate. And crews like the exclusive spring-activated feed plate which adjusts itself automatically to any size brush up to its rated capacity. This patented feed-plate provides protection from damage from foreign materials, makes for greater crew safety.

The Fitchburg Chipper is engineered to work fast, safely, and to be always "ready to go." It's the chipper which won't slow down your crews, lets you plan their work intelligently—saves you time and money.

Please send in the coupon for more information, and for copies of articles on chipping which appeared recently in leading publications. These feature articles describe five methods of brush disposal and ten new ways to utilize "by-product" chips. Send for your copies, they are well worthwhile.

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THE HIGHWAY AND AIRPORT DIGEST



Prepared by L. G. BYRD, Associate Editor

Speed Survey

Mass violations of unrealistic speed limits breed contempt for all regulatory signs. Most traffic engineers believe that speeds are safe and should be posted at that figure at or below which 85 percent of the people are driving. A re-evaluation of speed limits can be accomplished by an 85 percentile survey. An economical, easy-to-build speed measuring device is the Enoscope, an L-shaped box with a mirror mounted at 45° in the inside corner. The unit is painted black on the inside and can be covered with galvanized sheet steel so that it resembles a mail box. Two Enoscopes are positioned at 176' spacing parallel to the road and an observer sits in a plain car or old truck where he can look into the open end of the box. When a passing car obstructs the light in the near scope, the observer starts a stop watch. When the far scope is obstructed the watch is stopped and the elapsed time recorded. Speed is then calculated as being equal, in miles per hour, to 120 divided by the elapsed time, in seconds. A four or five hundred vehicle sample is sufficient to determine the 85 percentile speed.

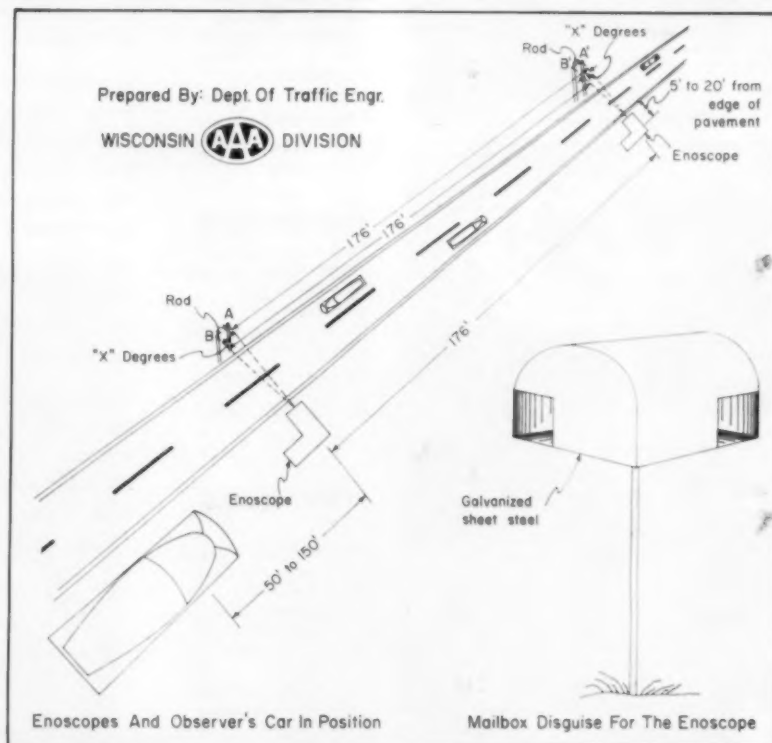
"How to Re-Evaluate Speed Limits, on City Streets." By Bryan Wilson, Traffic Engineer, Wisconsin Division, American Automobile Association. *Street Engineering*, May, 1961.

Electronics in the Highway Program

Developments in the field of electronics have contributed substantially to the advancement of highway technology. Today nearly all state highway departments use electronic computers and many are going to magnetic tape for faster data input-output and storage. Impres-

sive savings by use of computers are available in both dollars and hours. High-speed data transmission has become increasingly important in bringing data from the field to the computer center. Equipment is now available for data transmission over telegraph or telephone lines. Microwave radio facilities also offer an excellent data transmission potential in addition to vital communication services. Character reading devices have now been developed and promise an ultimate system linking optical scanning, high-speed data transmission, and electronic computation so that source data from the field automatically will be read and transmitted to the com-

puter center without manual processing. Electronic vehicle-guidance and warning systems are being studied in Ohio. Closed circuit television observation and traffic-sensing devices are combined in Michigan to permit traffic surveillance and instantaneous computation of density, volume, flow and speed of traffic on a Detroit freeway. A device has been developed for embedment in a bridge pavement where it will detect the presence of ice and energize an approach warning sign. Almost half of the states are now compiling cross-section data directly from aerial photographs in a stereoplotter that uses an electronic scaler; most states will use



● ENOSCOPE is used to survey traffic speeds for the purpose of arriving at a realistic limit. A 400 or 500-vehicle sample can determine the 85 percentile speed.

Courtesy Street Engineering

Versatile Michigan does work of two loaders, a crawler and a specialized snow removal unit; brings year-around economies to a city of 19,000. A typical saving:

2/3 cut in snow removal time

At least 5 important savings have been realized by the City of Cudahy, Wisconsin, since purchase of their 77 hp Michigan Tractor Shovel 4 years ago.

ONE, the Model 75A Michigan Tractor Shovel and its one operator have replaced two less powerful rubber-tired loaders and two operators.

TWO, a 15,000 lb class crawler-tractor, formerly needed for road grading, has been retired to non-travel duty on the Cudahy landfill.

THREE, Michigan's go-anywhere 26 mph mobility has eliminated truck-and-trailer transportation.

FOUR, the Michigan, equipped with

snow blower, does the job of a highly-specialized, summer-idle \$15,000 to \$17,000 rig.

FIVE, the Michigan, with standard 1¼ yd bucket, pays off, both winter and summer, by speeding all types of stockpile, highway-repair, other loader jobs.



Photo above shows typical summer-time taxpayer service . . . picking up broken walkway concrete. Other assignments of this type include pickup of earth, brush, rubbish . . . digging pit-run for landfill cover . . . loading stockpiled sand, gravel, and stone (av-



Alleys cleared, Michigan next removes curb-windrowed snow from main traffic and business routes. Here, for speed, the blower is used. This attachment consistently blows 4 cu yds into a truck in only 30 to 60 seconds! Time is "less than one-third" that re-

quired for bucket loading, according to Melvin Fiss, Cudahy Director of Public Works. "Another advantage of the blower," says Fiss, "is that it chops the often-icy snow so you get more than twice the weight into a truck-load as with straight bucket-loading."



erage: 10 tons in six passes, three minutes). Michigan also plays major role in highway construction: levels grades . . . spreads fill . . . tows rubber-tired roller and pulvi-mixer.

In winter, they replace the Michigan bucket with an easy-to-mount 9½ ft V-blade, plow alleys, occasionally city streets. To clear the 13¼ miles of alleys located within the city's boundaries takes the four-wheel-drive Michigan about eight hours. Machine's high-traction tires need no chains.



The City also uses the blower-equipped Michigan in undeveloped areas to throw windrowed snow 40 to 50 feet away from the road. This eliminates need for trucks and truck loading.

You can fit your 1 to 2¼ yd Michigan, new or old, with a blower, V-type, or

straight plow. See your Michigan Distributor for details on this investment in year-round money-saving versatility. Cudahy officials did. In 1960, the City bought its second Michigan, another Model 75A. Results: the savings you've just read about are now doubled!

**CLARK
EQUIPMENT**

Michigan is a registered trademark of

**CLARK EQUIPMENT COMPANY
Construction Machinery Division**

2499 Pipestone Road, Benton Harbor 30, Michigan
In Canada: Canadian Clark, Ltd., St. Thomas, Ontario

or have used one of the new nuclear gages for measurement of in-place moisture and density of embankments. Electronic devices are finding a place in many items of equipment including batching controls, gradeline and cross-section controls in pavers and blade controls in graders. Micro-wave controls of traffic signal systems and closed circuit television observations of activities ranging from construction projects to tunnel traffic flow are currently being employed.

"Economy, Efficiency and Electronics In The Highway Program." By H. A. Radzikowski, Chief, Division of Development, Bureau of Public Roads, Washington, D. C. A paper presented at the 40th Annual Conference of the Western Association of State Highway Officials, Las Vegas, Nevada.

No-Passing Sign

Over 17,000 no-passing signs have been installed on Iowa state highways. Iowa engineers assumed that the average driver would obey traffic laws and that passing violations resulted from inability of driver to see yellow paint lines or failure of lines to adequately impress the

driver of the law. The new pennant-shaped signs are reflectorized and mounted at 5-ft. heights on the left side of the road. The unique shape and left-side positioning command driver attention. Public acceptance has been enthusiastic and state highway patrol records indicate a 50 percent reduction in passing violations since installation of the signs.

"Iowa Extends Its Left-Side No-Passing Signs." *Roads and Streets*, May, 1961.

Highway Herbicides

Roadside vegetation control in New York State includes an important herbicide program followed by the Department of Public Works. Trained personnel from the highway maintenance forces apply the herbicides with equipment purchased especially for this purpose. District landscape architects program and supervise the work. Principal objectives are to cut costs, maintain safe and adequate sight distances, improve turf cover and appearance and eradicate noxious weeds. Two basic types of herbicides are used—those acting on the emerged plant and those acting below the soil surface. Control pro-

grams are developed to: eliminate vegetation around guide rails, posts and signs; remove broadleaf weeds; eliminate undesirable woody growth; and eradicate poison ivy from all areas where workmen, traveling public or adjacent property owners are likely to contact the plants. The latest equipment consists of skid-mounted power sprayers with 800-gal. steel tanks and multi-stage centrifugal pumps driven by gas engines with a capacity of 100 gpm at 200 psi. Other units owned by the dept. include 100, 200 and 600-gal. tank sprayers, all skid-mounted.

"Herbicides On Highway Road-sides." By John J. Ryan and Andrew M. Ditton, New York State Dept. of Public Works. *Rural Roads*, May, 1961.

Research Simulator

A driving simulator which would recreate the sensations of highway driving in a laboratory would enable vehicle designers to study driver reaction to automotive features; highway engineers could evaluate design features of the roadway and traffic engineers could determine the effectiveness of traffic control systems. Cornell University

ESSICK VR-28W VIBRATING COMPACTOR IGNORES COLD



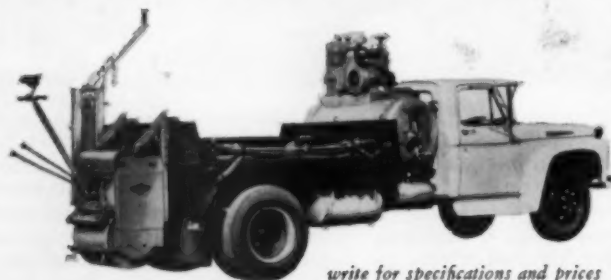
PERMANENT PATCH LAID IN 10° WEATHER

An Essick Model VR-28W Vibrating Compactor was used for winter street patching at St. Antoine des Laurentides on November 28, under the direction of Denis Legaré, Division Manager of District 5. Conditions for asphalt patching were at their worst as the temperature was 10°F. and the foundation was in very bad shape because the patch was put down where the previous material had not been compacted.

A cold stretch—4 feet wide by 15 feet long, and extending across the road—was rolled by the Essick Vibrating Compactor, supervised by Roger Poudrier of Desjardins Asphalt. The patch was quickly and densely compacted in two passes by the 28" wide, self-propelled unit, and was immediately opened to traffic. After more than 5 months of severe winter weather, the patch is like new and shows no deterioration. In normal cold paving conditions the asphalt would break up and have to be removed.

WINTER OR SUMMER—THE VR-28W GIVES THE BEST ASPHALT COMPACTION.

ESSICK "ONE TRIP" ASPHALT PATCH-FORCE UNIT



write for specifications and prices

LOWEST COST STREET MAINTENANCE AVAILABLE

NOW! The answer to the rising costs of city and county street maintenance in the form of a complete patching work unit involving one truck, two men, and Essick Road Maintenance Equipment:

- ESSICK VR-28W VIBRATING COMPACTOR, SELF-PROPELLED... WITH PATENTED CARRYING HOOKS, OFFERING IMMEDIATE DENSIFICATION—NO BARRICADES.
- ESSICK 200 GALLON TRUCK MOUNTED ASPHALT SPRAYER FOR TACK COAT AND SEALER COAT—AVAILABLE IN HEATED OR UNHEATED MODELS. 45 OR 58 CFM POWER UNITS.
- ESSICK 58 CUBIC FOOT AIR COMPRESSOR LARGE ENOUGH FOR RUNNING BREAKING TOOLS, PAINT SPRAY AND SAND BLASTING EQUIPMENT, ETC.
- ESSICK SH-20 ASPHALT SURFACE HEATER—PORTABLE, OPERATED BY ONE MAN, FIRED BY LP GAS FOR REMOVAL OF PUSH-UPS, BUMPS, GUTTER DRYING, ETC.

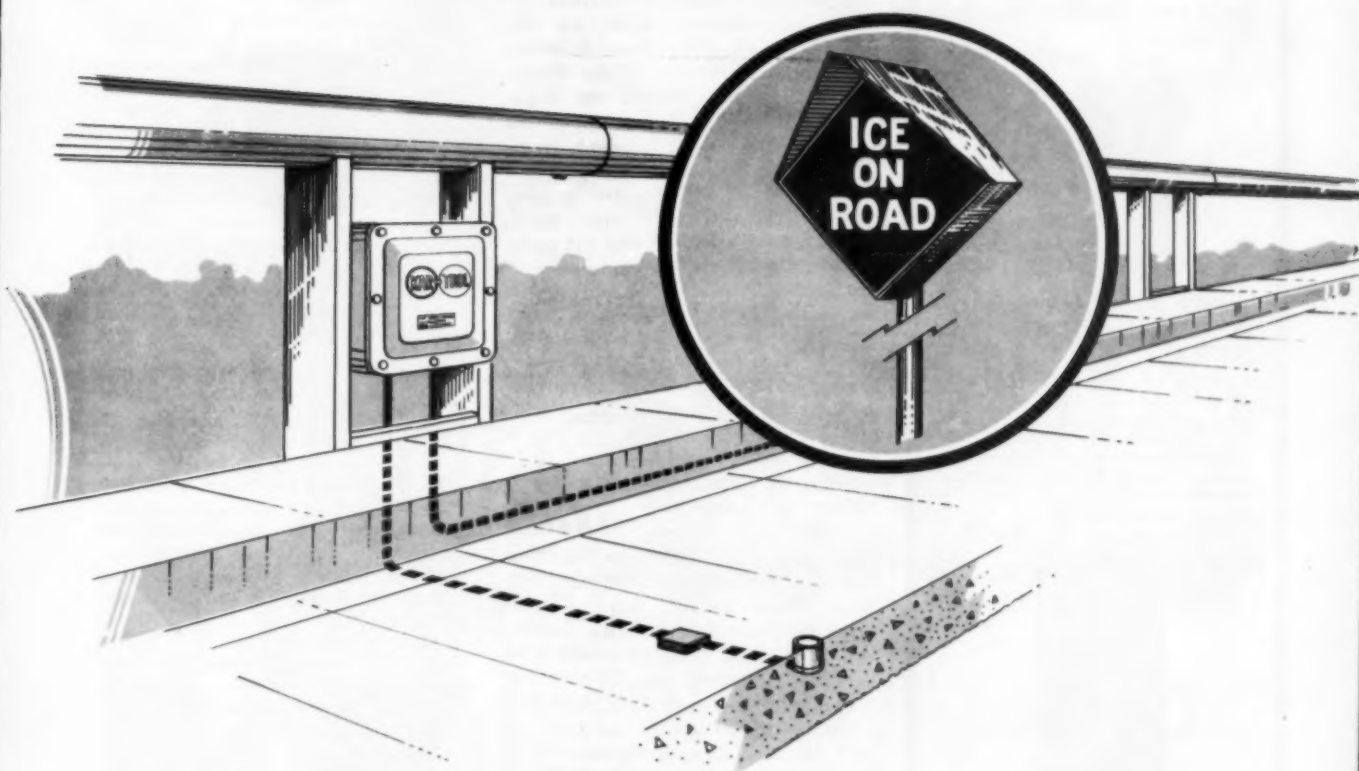
ESSICK MANUFACTURING CO.
affiliated with the T. L. SMITH COMPANY, Milwaukee, Wisconsin

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**AUTOMATICALLY AND IMMEDIATELY DETECTS
ICE, SNOW OR FROST ON SURFACE OF BRIDGES,
STRUCTURES OR ROADWAYS AND WARNS
APPROACHING TRAFFIC OF THESE CONDITIONS
BY THE USE OF BLANK OUT, WARNING SIGNS.**

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Write for full details, specifications and special applications.



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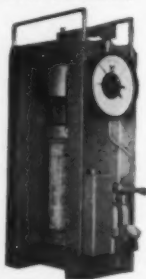
meet the exacting requirements of the construction industry's concrete testing applications.

Forney engineers are proven specialists in the concrete testing equipment field. For eleven years they have furnished the industry with quality testing equipment, accessories and supplies.



MODEL FT-30 HEAVY-DUTY PORTABLE CONCRETE TESTER

Latest addition to a complete line of portables, the FT-30 brings laboratory performance right to the job site. Self-contained power unit eliminates cumbersome hose and manual pumps. Loading speed is completely variable for accurate conformance to current ASTM standards.



MODEL FT-10 "JOBSITER"

LOWEST PRICED TESTER WITH HIGH PRICED FEATURES

- ✓ 250,000 Lb. Load Rating
- ✓ Designed to Protect Operator From Flying Fragments
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scientists, through a grant from the U. S. Public Health Service, have developed a design for a complex, highly realistic driving simulator. The Bureau of Public Roads, the Automotive Safety Foundation and the U. S. Public Health Service recently cosponsored the first National Conference on Driving Simulators at which simulator experts, traffic and highway engineers and vehicle designers gathered to determine the uses to be made of simulators. The development of a driving simulator is one of the top priority research projects recently cited by the Highway Research Board.

"Realistic Make - Believe." By Duane Cronk, Director, Highway Information Services, Washington, D. C. *Highway Highlights*, May, 1961.

Roadside Rest Areas

Ohio's rest areas are located at 25 to 35-mile intervals and are constructed in pairs, located back of the normal right of way lines on the new Interstate highways. Deceleration and acceleration lanes provide safe maneuvering of user traffic; curbed parking areas handle 35 cars and 12 trucks. The 3-acre minimum area is acquired as a part of the general right-of-way procurement. Buildings and picnic tables are constructed of treated lumber, with charcoal grills and tables placed on concrete slabs. New designs call for heated buildings to house flush toilets, wash basins, drinking fountains, bulletin boards and telephones. In areas adjacent to the State borders, an information center will be included. A caretaker is assigned full-time to each pair of rest areas. Usage surveys in Ohio showed about 7 percent of traffic stopping at roadside parks. On the Ohio Turnpike average trip about half the motorists stop at the service plazas. A recent check on Ohio's Interstate 71 showed over 17 percent of traffic stopping at the rest area.

"Roadside - Rest Sign Welcome Sight for Motorists in Ohio." By Wilbur J. Garmhausen, Chief Landscape Architect, Ohio Dept. of Highways. *Better Roads*, May, 1961.

Other Articles

"Photographic Records Aid Highway Condition Studies." New systems for photo-recording details of pavement surface conditions and driver-view of highway and surroundings. *PUBLIC WORKS*, June, 1961.

"Stabilization Saves Township Roads." Calcium chloride improves traffic-

bound surface stability while reducing maintenance costs. By Lloyd G. Byrd, Associate Editor, *PUBLIC WORKS*, June, 1961.

"Memphis Provides High Standards of Street Lighting Service." Operating its own utility division, Memphis provides continuing improvement of lighting facilities. By John T. Dwyer, Commissioner of Public Service, Memphis, Tenn. *PUBLIC WORKS*, June, 1961.

"Intermittent Rumble Strips Cut Accidents." An epoxy-resin binder holds aggregate on long-lasting rumble strips in Contra Costa County, California. By Mark L. Kermit, Traffic Engineer, Contra Costa County Public Works Department, Martinez, California. *Rural Roads*, May, 1961.

"Bridge Reconditioning." Old bridges are repaired by use of Armco bridge plank and bituminous concrete. By Stuart O'Flanagan, County Highway Commissioner, Dunn County, Wisconsin. *Highway Magazine*, May, 1961.

"Realistic Fee Schedules for Consultants." Ohio's Highway Specifications for Consulting Engineer Service serves as a guide to the establishment of equitable and professional relationships. By Robert Wm. Meyer, Executive Assistant of Metropolitan Expressways, Ohio Department of Highways, Columbus, Ohio. *PUBLIC WORKS*, June, 1961.

"Rush Job in Detroit: Million-Dollar Temporary Road." Extension of John C. Lodge Freeway requires construction of temporary road to serve for three years in the four-part stage construction program. *Roads and Streets*, May, 1961.

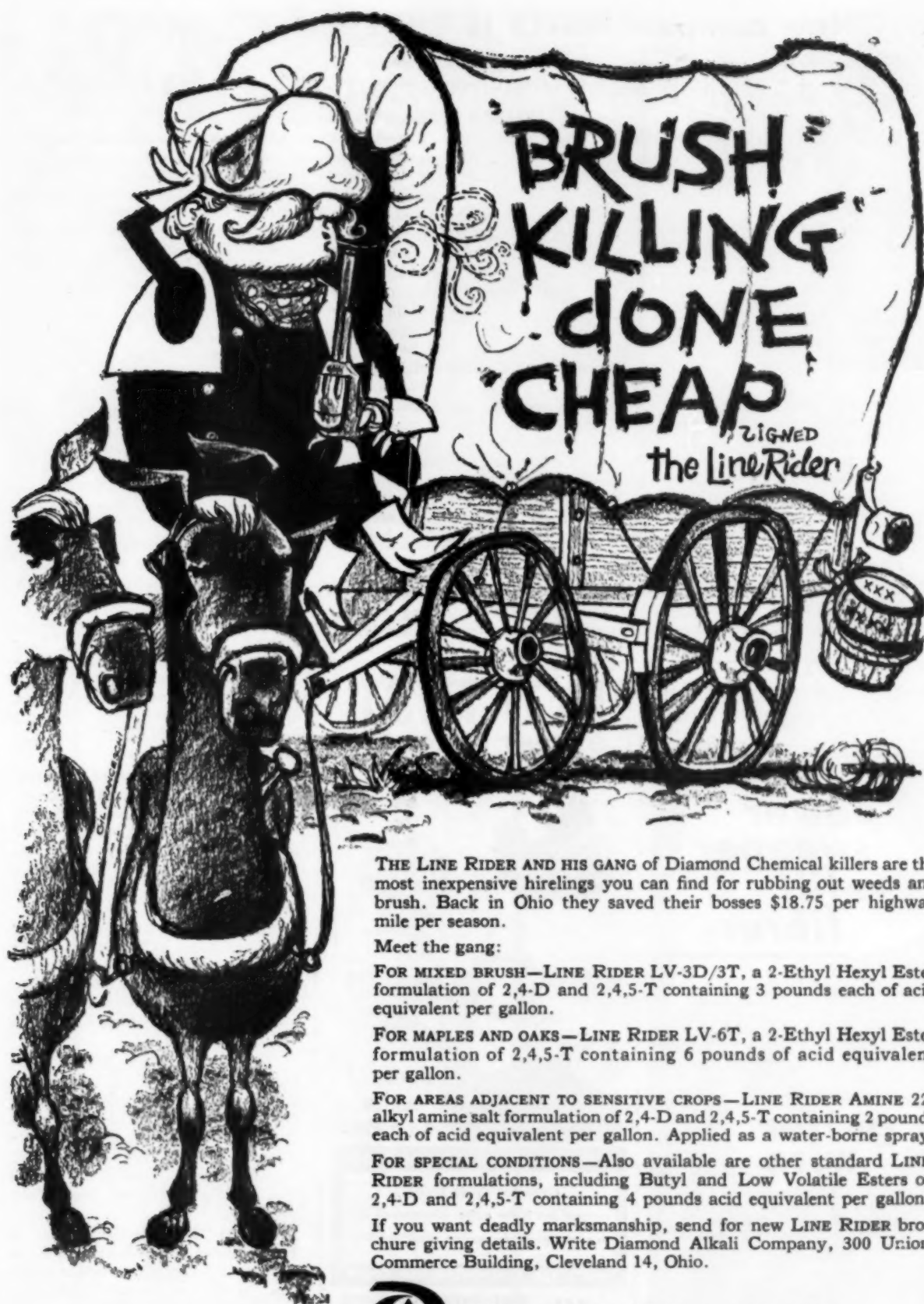
"Improved Center Stripe Procedure." The Texas Highway Department finds that paint heater permits constant viscosity control, uniform film thickness and faster drying. *Texas Highways*, May, 1961.

"Scale Models Can Help Sell County Highways." First scale model of county highway project has been extremely useful in work of public-information section. By Merle L. Kruschke, Administrative Assistant, Hennepin County Highway Dept., Hopkins, Minn. *Better Roads*, May, 1961.

Motorcycles Banned on New Jersey Parkway

While motorcycles constituted only approximately one-tenth of one percent of New Jersey Garden State Parkway traffic, they were involved in 5.7 percent of the fatal accidents during a period of study in 1959 and 1960. As a result of this investigation, motorcycles were banned from the Parkway early in 1961.

In 1960, the Parkway fatality rate was 1.01 deaths per 100 million miles of travel. The overall accident rate was 86.7 per 100 million miles, the personal injury rate 49.2 and the injury accident rate 29.6.



THE LINE RIDER AND HIS GANG of Diamond Chemical killers are the most inexpensive hirelings you can find for rubbing out weeds and brush. Back in Ohio they saved their bosses \$18.75 per highway mile per season.

Meet the gang:


FOR MIXED BRUSH—LINE RIDER LV-3D/3T, a 2-Ethyl Hexyl Ester formulation of 2,4-D and 2,4,5-T containing 3 pounds each of acid equivalent per gallon.

FOR MAPLES AND OAKS—LINE RIDER LV-6T, a 2-Ethyl Hexyl Ester formulation of 2,4,5-T containing 6 pounds of acid equivalent per gallon.

FOR AREAS ADJACENT TO SENSITIVE CROPS—LINE RIDER AMINE 22, alkyl amine salt formulation of 2,4-D and 2,4,5-T containing 2 pounds each of acid equivalent per gallon. Applied as a water-borne spray.

FOR SPECIAL CONDITIONS—Also available are other standard LINE RIDER formulations, including Butyl and Low Volatile Esters of 2,4-D and 2,4,5-T containing 4 pounds acid equivalent per gallon.

If you want deadly marksmanship, send for new LINE RIDER brochure giving details. Write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

 **Diamond Chemicals**

New compact MASTER 10 MARKER replaces truck-mounted markers...



It's true . . . the new Master 10 has the same capacity (120 gal.), the same versatility (lays 1, 2, or 3 lines 3" to 6", 1 or 2 colors), marks equally fast (3 speeds up to 10 mph, plus reverse), . . . yet costs 1/3 less than truck-mounted markers. What's more, this self-propelled, one-man operated, all purpose striper is only 50" wide, thus eliminating traffic tie-ups while marking city, county or state roads. It's a money-saver in price, operation and maintenance . . . let us prove it. Write M-B Corp., New Holstein, Wisc., Dept. PW



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SWEEPERS

A DEPENDABLE BUYING SOURCE

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Wide variety of domestic and imported fibres. Large or small filled immediately from huge warehouse stock.

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HEATED
Asphalt Roller

5 TON COMPACTION WATER-TIGHT SEAL

OVER 300 CITIES REPORT,

"Hot Roll is the major advancement

In recent years for asphalt street repair".

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FILMS in Brief

Listed below are motion picture films of current interest to engineers, administrators and supervisors in the public works field. The companies providing these films have indicated that the films are available for appropriate use by PUBLIC WORKS readers. Requests for films should be made direct to the company listed with the film.

"Demand Decision." Creates a public awareness of the need for and benefits of better highways by dramatizing a local highway situation and its resolution through organized community effort. (17½ min., color, sound.) Better Highways Information Foundation, 2000 K Street, N.W., Washington 6, D. C.

"Pipelines To Health." Presents the basic facts concerning community sewer facilities of interest to planners, engineers and taxpayers. (23 min., color, 16 mm.) Johns-Manville, Pipe Division, 22 East 40th St., New York 16, N. Y.

"Deep Waters." The story of ground water development, how water reaches underground formations, how it is located, and how it is produced in ample quantities. (22 min., color, sound, 16 mm.) Layne & Bowler, Inc., Dept. AD, Memphis 8, Tennessee.

"Continuous Reinforced Concrete Pavements." Presents all construction features with animated description of pavement behavior and theory. (23 min., color, sound, 16 mm.) Rail Steel Bar Association, 38 South Dearborn St., Chicago 3, Ill.

"Guardians of Communications." The advantages of Transite ducts in telephone installations. (25 min., color, sound, 16 mm.) Motion Picture Department, Johns-Manville Corp., 22 E. 40th Street, New York 16, N.Y.

"Asphalt Paves the Way." Illustrates the manufacture, testing and distribution of asphalt for road construction and the design and construction of major types of bituminous paving. (39 min., color, sound, 16 mm.) Esso Standard Oil Co., 15 W. 51st Street, New York 19, N.Y.

"Dial It." Explains the function of Preco Dial-A-Slope automatic blade control attachment for motor graders. (12 min., color, sound, 16 mm.) Le-Tourneau-Westinghouse Co., 2301 N.E. Adams St., Peoria, Ill.

H-30 PAYLOADER



**"the most useful
single machine"**

The City of Thomasville, N. C., has 120 miles of streets — 85% paved. It does practically all its own street construction and the present program involves 5 miles of streets — grading, widening, drainage, base material, curb-and-gutter, and resurfacing. One of its key machines is an H-30 PAYLOADER with patented Drott "4-in-1" bucket.

Public Works Director Joe F. Mitchell says, "It is the most useful single machine I have ever known for street work. It does jobs faster, saves hand labor and often does the work of several different machines. It has reserve power for hard digging, good load-carrying balance, and unusual operator visibility."

The Model H-30 is the smallest 4-wheel-drive PAYLOADER but has a full dumping clearance of 8' 4", 3000-lb. operating capacity and all the modern features of the largest models. Although introduced only a year ago, it has become very popular with public bodies, many of whom have already made repeat purchases. Your Hough Distributor is ready to show you how useful and valuable the H-30 or larger PAYLOADER models can really be. See him today, or write.

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● SLOPING drainageway, shown at left with Troyturf staked in place and at right, as it appeared several weeks later.

Seeded Grass Blankets Prevent Highway Erosion

TROYTURF, a seeded grass blanket, is now under test by the New York State Public Works Department to replace sod for prevention of soil erosion in some state highway drainageways.

When installed during the growing season, the grass blanket produces an adequate grass cover which permits it to withstand running water and prevent erosion to the sloping drainageways.

Erosion of these steep drainage ditches has been a concern to the Public Works Department. Sod, one of the materials that was used in these areas, involved an expensive and slow installation procedure. In addition, it had several other disadvantages, such as: 1) It had a limited availability in some areas of the state; 2) it had to be used shortly after cutting to prevent spoilage; and 3) it could not be ob-

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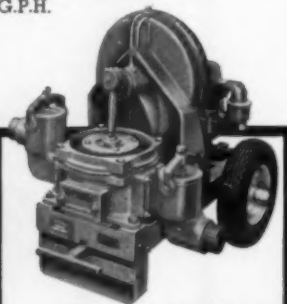
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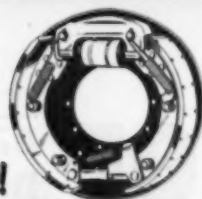
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A practical way to speed "routine" road maintenance

Most of your grader work is probably a lot like that pictured here . . . "routine" maintenance chores. They require nothing unusual in the way of power, little special equipment, and ordinarily they can be handled without "paper work." But, the *difficult* thing about these jobs is that there are so very many of them to do all of the time!

That's why hundreds of public agencies choose LeTourneau-Westinghouse Model 440 and 550 graders for this type of work. Owners prefer them because these LW machines are *faster*

than all other graders in their power class . . . they can *complete* more assignments in less time.

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Consider travel speed, for instance: The "440" and "550" get from job-to-job at speeds to 25.2 mph. *That's 25% faster than the average top speed of any other "medium-size" grader on the market.* And with a top reverse speed of 13.2 mph, these LW graders are a full 59% faster than the average!

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MPH advantages, however, are only *one* reason why LW motor graders get more work done faster. To understand their true value it will be worth your while to see an LW operate on one of your roads. We will be happy to demonstrate the size grader that fits your needs. 7 models, 85 to 190 hp. Ask for details.

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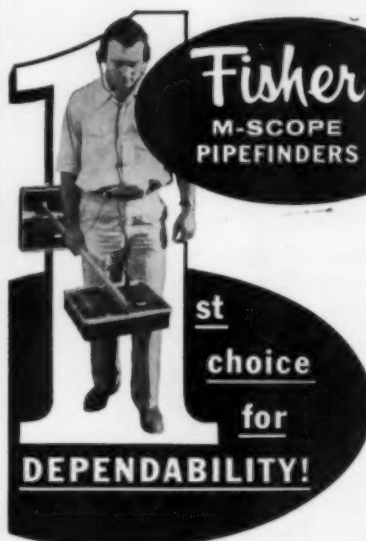
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tained when the ground was frozen or exceedingly wet and usually, placement was restricted in mid-summer.

After the soil had been finished roughly and hand raked, the end of the seeded blanket was placed at the lower end of the drainageway and was pegged down to hold it in place. The blanket was then rolled out from the staked end cut to the desired length. The upper end is placed in a trench which is then back-filled. The entire length of the mat is pegged down to hold it in place. No regular seeding of the ground, or overseeding of the blanket, was necessary.

The simple rolling out and pegging down installation procedure was much faster than the previous method of hand placing individual sections of sod.

In the Fall of 1960, the Public Works Department began an experiment to determine the blanket's durability. It installed the seeded mat in the late fall when germination was no longer possible. This was done to determine whether the blanket could withstand running water, prevent erosion to the drainageway and produce an adequate grass cover the following spring.

Troyturf, manufactured by Troy Mills, Inc., Horticultural Division, consists of a 20-ounce mat of jute, a bottom layer of special paper, seed, fertilizer, pH control, Vermiculite, organic mulch and other ingredients. The seeded grass mats have been used by other state highway departments to grow grass in difficult highway locations.

Special Highway Program Provides More Jobs

The Michigan State Highway Department has hired 250 unemployed workers for a special state-wide cable guard rail rehabilitation project. The men will put in new wooden posts to replace those which have become rotted and out of line during the past 10 to 15 years. Cables will also be restrung. The special maintenance project was made possible through a savings in winter maintenance on state trunklines because of the comparatively mild winter according to J. C. Mackie, State Highway Commissioner.

The guard rail program is the second special project instituted by the State Highway Department Maintenance Division this year; 65 men were hired recently for a special 90-day Dutch Elm tree removal program.

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This 232-foot-long culvert will carry irrigation water under a new four lane highway near Livingston, Montana. It's made from USS AmBridge Sectional Plate: a tough, zinc-coated corrugated steel product that's famous for long life. Many steel culverts like this one have already outlasted the highways they were buried under.

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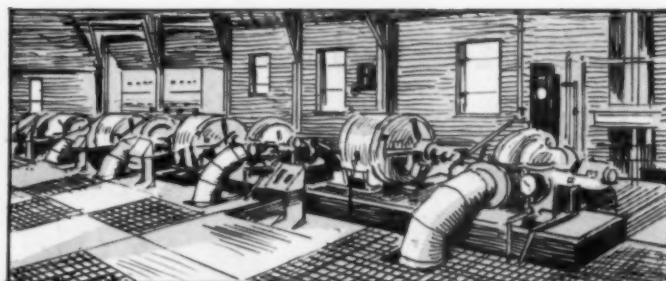
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THE WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

County Water System

Essex County's Union Water System, located in the province of Ontario, Canada, serving a population of approximately 12,000, was the first integrated water system undertaken by the Ontario Water Resources Commission. One of this commission's primary responsibilities is to help any municipality or group of municipalities to obtain an adequate supply of pure water and to dispose of its sewage and industrial wastes in an economical and sanitary manner. Under the financing plan of the commission, the municipality is supplied the necessary funds by the commission, and the credit of the province is pledged for this purpose. The debt is paid over a long period, 30 years in most instances, and the interest rate is the actual cost of money borrowed by the province, which rate is usually lower than it is possible for a municipality to obtain on its own. The administration of the Essex County Union Water System is under the auspices and control of the Ontario Water Resources Commission which operates and maintains the plant and trunk water mains. The individual municipalities are responsible for their own distribution system. The treatment processes comprise coarse screening, followed by low lift pumping and micro - straining; solids contact clarification preceded by chemical application and prechlorination; and the final processes of rapid sand filtration, storage, and post-chlorination. The modern functional and efficient operation of this water treatment system is achieved by the incorporation of automatic control equipment arranged to operate from a centralized Master Control Panel which enables the operator to place

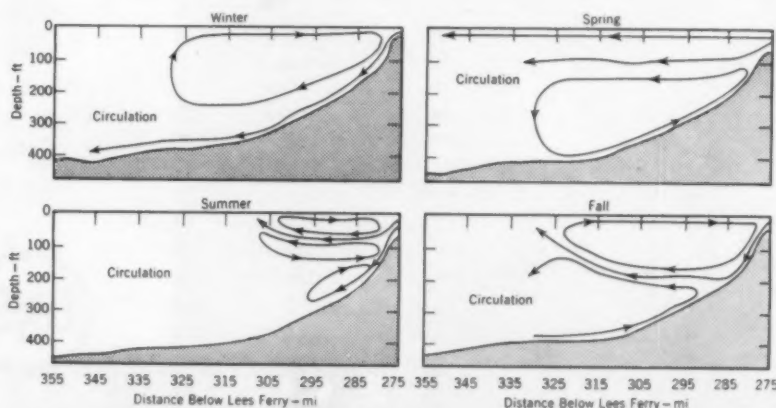
the plant in fully automatic operation. In addition, the plant is provided with proportional control facilities for chemicals, chlorine, and compensations for distribution system flow variations. By the use of automation in this plant it has been possible to provide water treatment and distribution for unusual demand conditions without the need for a considerable work force to operate it.

"County Water System Features Advanced Automation." B. C. G. Russell Armstrong, Consulting Engineer, Windsor, Ontario. **PUBLIC WORKS**, June, 1961.

Impoundment And Quality

In recent years water quality has become one of the foremost topics of discussion by technical and non-technical people in dealing with water supply development and use. Among the many things that affect water quality is impoundment. Important beneficial effects include: 1) reduction of turbidity, silica, color

(in certain reservoirs), and coliform bacteria; 2) evening out of short variations in dissolved minerals, hardness, pH, and alkalinity; 3) reductions in temperature, which sometimes benefit fish life; 4) entrapment of sediment; and 5) storage of water for release in dry periods for the dilution of polluted waters. In addition to benefits, impoundment also has certain undesirable effects, including: 1) increased growth of algae, which may give rise to tastes and odors; 2) reduction in dissolved oxygen in the deeper parts of the reservoirs; 3) increase in carbon dioxide and frequently iron, manganese, and alkalinity, especially near the bottom; 4) increases in dissolved solids and hardness as a result of evaporation and dissolution of rock materials; and 5) reductions in temperatures, which although sometimes beneficial, may also be detrimental to fish life. Among the more significant factors are differences in density of both the inflowing and the stored water. These density differences are caused by variations in temperature,



Courtesy Journal AWWA

● CURVES show the circulation patterns in Lake Mead for the four seasons.

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Glimpse of new subdivision of San Jose,
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Carloads of IOWA gate valves and hydrants were purchased by the San Jose Water Works (an investor-owned, private company established in 1866) for installation in their rapidly expanding system which serves seven cities and unincorporated areas in Santa Clara County, California.

Over 17,000 new water service connections were made in the last two years along 1200 miles of water mains to help care for a metropolitan population (Approx. 306,000) which has doubled since 1950.

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salinity and suspended matter. Reduction in velocity of inflowing turbid water can cause a reduction in density by permitting suspended matter to settle out. Other factors affecting water quality are evaporation, wind movements, dissolution or precipitation of mineral species, and biological activity. One of the most comprehensive studies of reservoirs was made on Lake Mead in 1948-49. Several of the most important factors are discussed in this article. Another study briefly discussed is the 20 years of experiences in the Tennessee Valley. Records of chemical quality of the Potomac

River have been collected for many years at the Dalecarlia filtration plant in Washington, D. C. and are discussed briefly. These and many other studies of stream impoundments have been made, and much valuable information has been obtained. Unfortunately, most of the studies have been more qualitative than quantitative. If more adequate information were available from existing impoundments, it should be possible to evaluate all pertinent factors and thus predict, in designing a new dam, what effects the dam and reservoir will have on both natural resources and cultural

developments in the adjacent area. "Relationship of Impoundment to Water Quality." By S. Kenneth Love, Chief, Water Quality Branch, USGS, Washington, D. C. *Journal AWWA*, May, 1961.

Microstraining Helps Kenosha

For the past two years the water treatment plant at Kenosha, Wisconsin has exceeded its rated capacity of 20 mgd, resulting from a 22 percent population increase between 1950 and 1960; plus annexations of 550 acres in 1960; and the laying of 38,000 ft. of new mains which serve 625 additional consumers. The treatment plant has provided disinfection and alum coagulation followed by sedimentation and filtration for water from Lake Michigan and plans and specifications have been prepared to double the plant capacity, but construction will not be completed until 1963. Pushing the operation of the plant beyond its capacity resulted in short filter runs caused primarily by algae. Preliminary investigation on the possibility of straining the raw water prior to filtration resulted in the decision to obtain and install a Microstrainer pilot plant. Algae reductions through the pilot plant varied from 56 to 97 per cent, with a two-month average of 87 percent. From these demonstrated results, plans were prepared for the construction of the necessary Microstrainer basin. Also, four 10 ft. diameter x 10 ft. wide Microstrainers have been ordered for delivery and installation for operation by June 1, 1961. Each of the units will have Mark I stainless steel fabric, motor reduction gear, and manually controlled variable speed drive. Plans have also been made to install the Microstrainers in the future 40 mgd treatment layout with the approval of the Wisconsin State Board of Health.

"Microstraining Helps Kenosha." By O. Fred Nelson, Manager, Water Department, Kenosha, Wisconsin. *Water & Sewage Works*, May, 1961.

World's Largest Water Plant

Chicago's Central District Filtration Plant, having a rated capacity of 960 mgd, and being capable of handling up to 1700 mgd peak load, will serve the north two-thirds of the City of Chicago and some thirty communities west and northwest of the city. The cofferdam required for dewatering the centrally located

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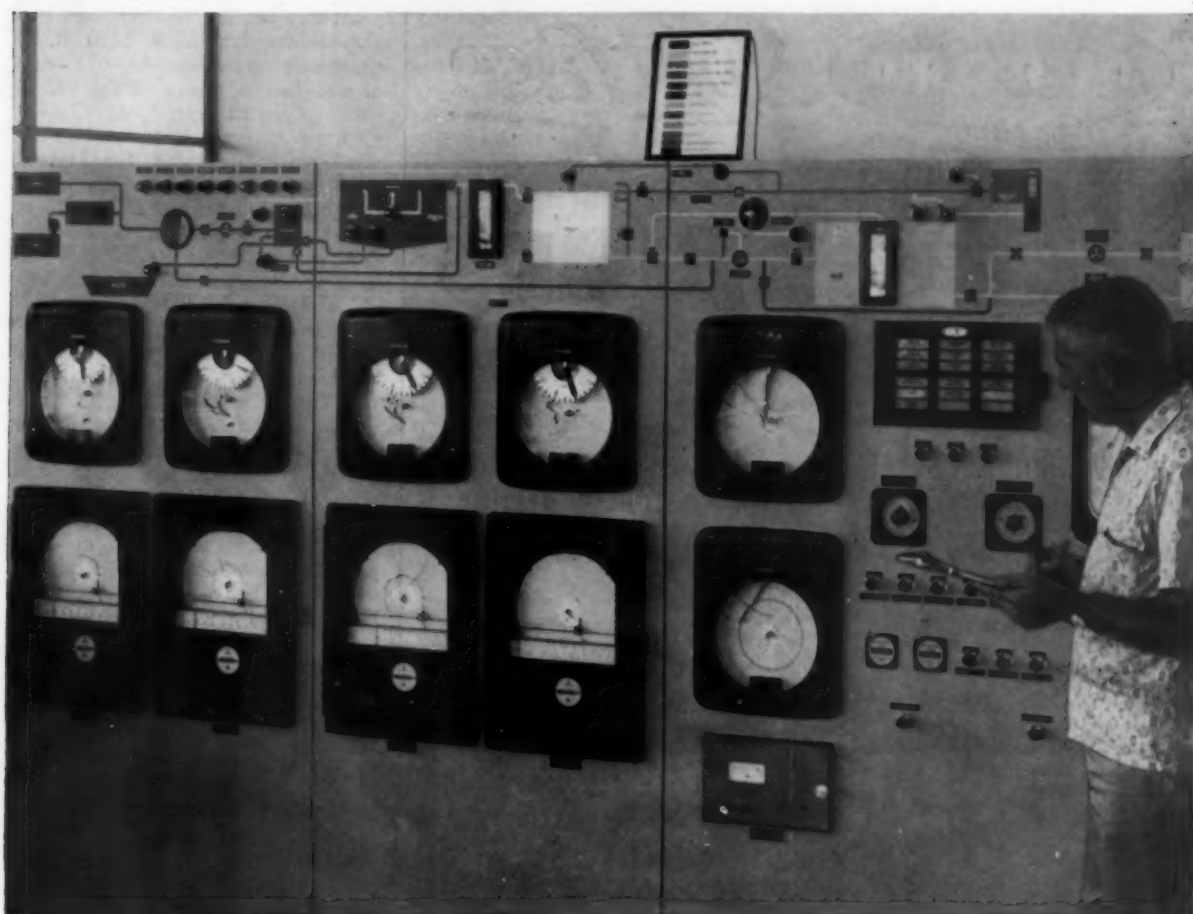
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**Marin Municipal Water District
San Rafael, Calif. reports**

Winter rains washing mud into supply lakes posed a difficult problem for the Marin Municipal Water District. To insure best possible operation of their Bon Tempe Filtration Plant, special attention to chemical addition and filtering was imperative.

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Foxboro pneumatic instruments record and control flow, level, and back wash rate for each of the

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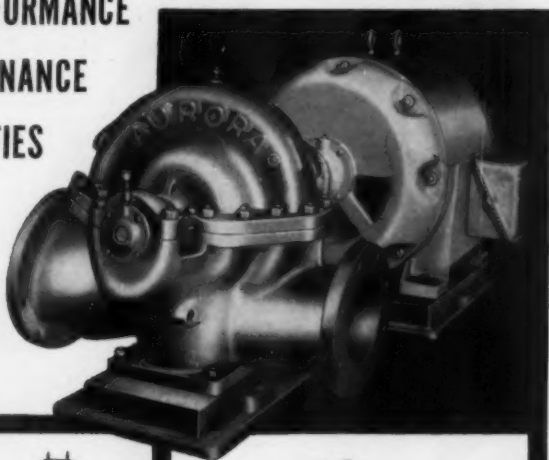
Foxboro-instrumented Bon Tempe Filtration Plant, San Rafael, California. Plant was built to serve the burgeoning population of the Marin Municipal Water District. Kennedy Engineers, San Francisco, were Consulting Engineers.

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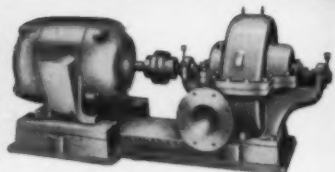
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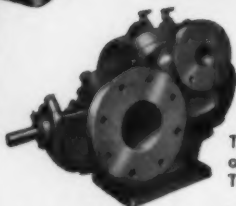
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plant site was 1100 ft. wide and had an average length of 2,650 ft. It permitted the dewatering of 61 acres of the bed of Lake Michigan, 44 acres of which would be occupied by the plant substructures. The filtered water reservoir, the first of the structures to be built within the cofferdam, has an average width of about 480 ft., is 964 ft. long, 20 ft. deep and has a capacity of approximately 69 million gallons. It is divided into two halves with the smaller north half providing water to the North Water District and the larger south half providing water to the Central Water District. The mixing basins are of the axial flow type consisting of four channels with slotted walls between the last channel and the upper level of the settling basins. Paddle type flocculators are used, operating at peripheral speeds of approximately 1 or 1½ ft. per second in the first channel and approximately 0.7 or 1.2 ft. per second in the other three channels. Sediment removal equipment is being installed in the upper level only of the settling basins. A special flushing line with nozzles is being installed for removal of accumulated sediment in the lower level basins. The filters, each with a rated capacity of 10 mgd, are of the dual type with two manifolds, each having filter effluent control and wash water valves, but with common influent and wash water drain valves. The Central District Filtration Plant is being designed to feed chemicals in the liquid or slurry form. Alum, ferric sulfate, hydrofluosilicic acid, and anhydrous ammonia will be fed in the liquid state while activated carbon and lime will be handled as slurries. For all practical purposes, the Central District Filtration Plant may be operated as one, two, or four plants, providing for great flexibility of operation. The plant is being financed entirely through water works certificates issued for its construction and retired by funds collected as water revenue.

"The World's Largest Water Filtration Plant." By George S. Salter, Chief Filtration Design Engineer, Department of Public Works, Chicago, Illinois. PUBLIC WORKS, June, 1961.

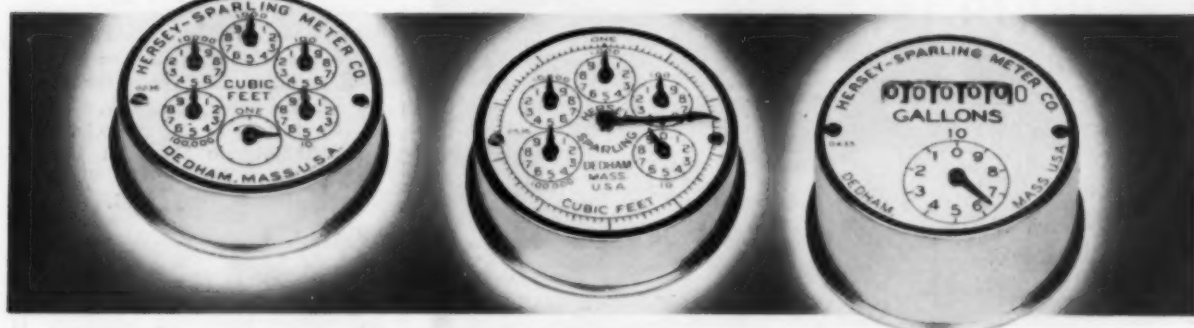
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PUBLIC WORKS for July, 1961



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as a coagulant and a polyacrylamide as a filter conditioning agent has saved over \$750,000 in chemicals since its adoption. Water of improved quality has been produced by the new process and filter rates are higher than with the silica process. The theory of the action of the filter conditioner is the agents act to bond the alum floc particles to the filter grains and to each other, the agents acting as a glue. The switch to the filter conditioners resulted in much simpler control of the alum dosage than was necessary with the use of the activated silica as a coagulant aid. Filter conditioner dosage is easy to estimate by use of one of the fast and sensitive methods of measuring filtered water quality. Plant capacity can be increased by the use of filter conditioners as it has been demonstrated at Hanford for the past 3 or 4 years.

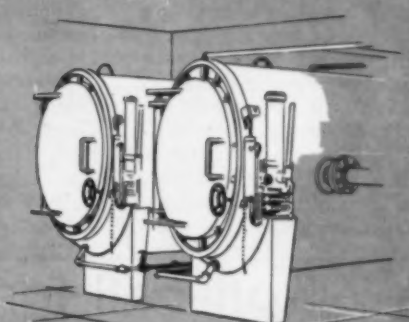
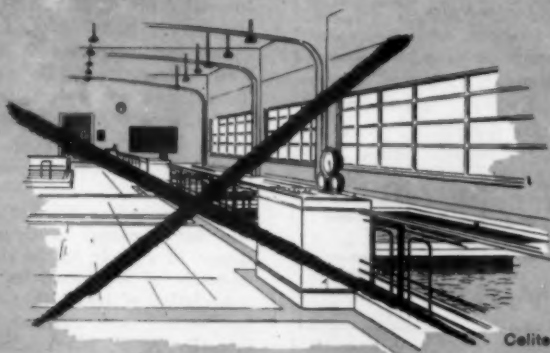
"Coagulant Aids As Filter Aids."

By W. R. Conley and R. W. Pitman, Research and Engineering Section, Hanford Atomic Products Operation, General Electric Co. Water & Sewage Works, May, 1961.

Watershed Management

Siltation of ponds and reservoirs in widely separated localities is slowly filling up the nation's reservoirs. Before one can establish whether this condition must exist one must examine the facets of watershed management and gain a better understanding of what is involved. Watershed management is the scientific application of the principles of watershed processes for the protection, improvement, and management of watersheds, and has these basic objectives: 1) To improve water supplies; 2) to reduce the range between extremes of streamflow (especially low flows and destructive flooding); 3) to reduce sediment production; and 4) to improve water quality for diverse uses. To obtain a better understanding of the principles and problems of watershed management, one area has been examined in detail. The data were obtained largely from the Davis County Experimental Watershed, situated in the Wasatch Mountains midway between Salt Lake City and Ogden, Utah. In order to show the effects of land use on water yields, a comparison has been made of the discharge characteristics of two adjacent mountain watersheds of contrasting use history. Studies have established certain principles of watershed management to increase water yields. Among these are: 1) Deep-

1. REDUCE FILTER HOUSING SPACE 75%



Celite diatomite filtration equipment takes up only about one-quarter the space of equivalent-capacity sand filter systems.

2. USE LOWER-COST CONSTRUCTION



Smaller floor space needed for diatomite filtration permits lighter, lower-cost building methods and materials.

You save filtration construction dollars these 2 ways with Celite diatomite

One installation after another proves you need about 75% less filter housing space for equivalent capacity when you use diatomite filtration with Johns-Manville Celite*.

Also, diatomite's lighter, smaller equipment permits you to use lower cost building methods and materials. For example, a simple concrete slab with light framing and siding instead of a large reinforced concrete-and-brick building with built-in concrete filters#.

Diatomite filter equipment is so compact because it provides a much larger filter surface in proportion to size of equipment. In many cases, raw water can be filtered directly—pretreatment facilities can be eliminated. For Celite removes more suspended solids, including amoebae and algae, and turbidity is usually much lower.

Mined by Johns-Manville from the world's largest and purest commercial diatomite deposit, Celite is carefully processed for purity and uniformity. It is available in a wide range of grades for best practical balance of clarity and flow rate with any suitable filter. For further information, see your nearby Celite engineer. For free technical reprints and illustrated brochure, write to Johns-Manville, Box 14, N.Y. 16, N.Y. In Canada, Port Credit, Ont.



*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

#See *Comparison Studies of Diatomite and Sand Filtration* by G. R. Bell, Journal American Water Works Association, September, 1956 or write for free reprint.

JOHNS-MANVILLE

rooted plants create greater soil moisture deficits than plants with shallower root systems; 2) deficits in soil moisture must be replenished before water will percolate through the soil to recharge ground water and maintain streamflow; 3) thinning of dense coniferous stands on northern slopes in areas of heavy snowfall allows more snow to reach the ground and thereby increases water available to streamflow; 4) on deep soils, conversion from deep-rooted to shallow-rooted vegetation makes more water available for streamflow if conditions for infiltration are satisfactory and if precipi-

tation is sufficient to wet down through the root zone. Unfortunately, a treatment desirable for improving one feature of water yields may be incompatible with another that is equally desirable. Thus each situation must be resolved independently, and in light of the particular advantages and disadvantages that may develop.

"Water Management and Reservoir Life." By Otis L. Copeland, Chief, Div. of Watershed Management Research, Intermountain Forest & Range Experiment Station, U. S. Forest Service, Ogden, Utah. *Journal AWWA*, May, 1961.

Other Articles

"Survey of AWWA Aims and Objectives." A report of the Ad Hoc Committee on Review of AWWA Aims and Objectives, submitted to the AWWA Board of Directors on Jan. 22, 1961, by Fred Eidsness, Chairman. *Journal AWWA*, May, 1961.

"Relation Between Aquifer Permeability and Improvement Achieved By Well Stimulation." This article is the fourth of a series by the author on various aspects of well stimulation. By Louis Koenig, Research Consultant, San Antonio, Texas. *Journal AWWA*, May, 1961.

"Electrophoretic Studies of Coagulation for Removal of Organic Color." Report of a study on the change in the mobility of floc particles during the coagulation of two highly colored surface waters with alum and ferric sulfate. By A. P. Black, Research Prof. of Chemistry & San. Science, Dept. of Chemistry, Univ. of Florida, Gainesville, Fla., and Donald G. Willems, San. Engr., State Board of Health, Helena, Mont. *Journal AWWA*, May, 1961.

"Application of Fluorides to Water." A summary of a study of fluoridation practices of 20 major U. S. cities. By William T. Ingram, Adjunct Prof., New York University College of Engr., New York, N. Y. *Water & Sewage Works*, May, 1961.

"Microstrainers to Remove Insect Larvae." New units promise economical means for removing "white worms" from the Stamford, Conn. water supply. By C. C. Wilbur, Chief, Water Works Section, Gannett, Fleming, Corddry & Carpenter, Inc., Harrisburg, Pa. *Public Works*, June, 1961.

"La Protection Cathodique des Conduites." Review of causes and methods of cathodic protection of water mains. Par J. Franquin, Ingénieur chimiste, Ingénieur géologue, Docteur ès Sciences, et R. Vulcain, Ingénieur I. E. G. Techniques et Sciences Municipales, Mars, 1961.

"Sanitary Aspects of Watershed Management." A comprehensive and detailed report of good practices and guidelines for reservoir sanitation. Adopted by the Arkansas-White-Red Basins Inter-Agency Committee in November, 1960, entitled "Guidelines for Reservoir Sanitation." *Public Works*, June, 1961.

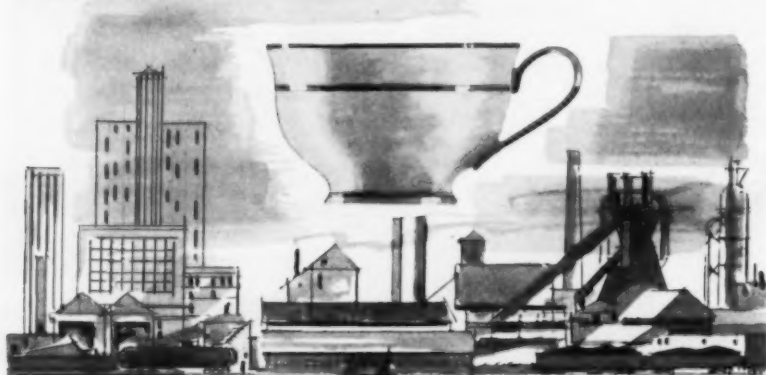
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County Refuse Collection

Formed to provide water and sewerage services for suburban areas adjacent to the District of Columbia, the Washington Suburban Sanitary Commission now has responsibility for refuse collection in parts of suburban Montgomery County, Maryland, and for disposal facilities in both Montgomery and Prince George Counties.



Roll-call for water



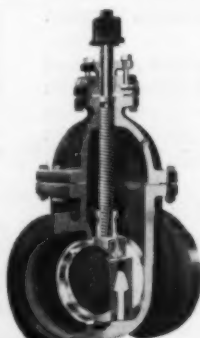
a CUP of WATER

Because until recently it always was available, a cup of water here has been considered a "little thing." Today, we suddenly realize that many water facilities are deficient . . . and a "cup of water" in some places no longer is a little thing!

Of the total population, 26.6 per cent or approximately 25 million citizens of the U.S.A., definitely have inadequate water supply.* In addition water supply is uncertain for 23.2 per cent of the population or nearly 21 million more. Only 50.2 per cent of the population, or approximately 45 million people, enjoy adequate water service. Of 587 water works systems, serving 25,000 population or more each, service is inadequate or uncertain in 255 of them! The U.S. Department of Commerce estimates that water supply facilities within the next 20 years will need to be doubled.

Municipal and utility officials know this situation but in many cases need better public support before they can make a move. In future advertisements, we will attempt to sketch brief facts about the water shortage of particular groups of states.

*Survey by Water and Sewerage Industry and Utilities Division, Business and Defense Services Administration, U.S. Department of Commerce, Washington, D. C.

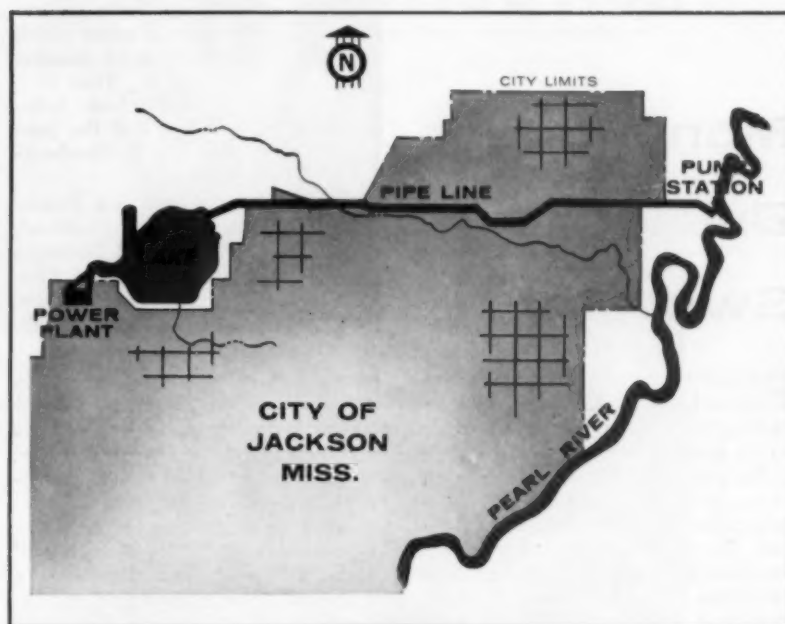


M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA



385 Acre Lake Filled By

Six Mile Concrete Pipe Line At Jackson, Miss.



Building a reservoir to provide cooling water for a power plant is not unusual. But to supply it with a 6-mile, 20-inch pipe line is.

The Mississippi Power and Light Company's Rex Brown Station at Jackson planned to triple its capacity, but was concerned that pulling more ground water from its wells might materially affect the ground water supply in the area.

They came up with the idea of a

reservoir on a nearby unused piece of public land that would do the job. And although some surface water would find its way into the lake, the primary source of water would have to come from somewhere else.

Engineers picked the Pearl River, on the other side of Jackson, as that source. The pumping station was erected, the six-mile prestressed concrete steel cylinder pipe line was laid, and 8,000,000 gallons per day started to flow into the

lake. In six months the lake was filled.

The pumps are turned on or off to maintain the water level and according to Consulting Engineers Michael Baker, Jr., Inc. of Jackson, Miss. and Rochester, Pa., the results have been extremely satisfactory.

Taylor-Wheless Company installed the pipeline. Price Brothers Company, with headquarters plants in Hattiesburg, Miss. and Dayton, Ohio, manufactured the pipe.



Far left: A trencher was used on the job. Note backhoe picking up pipe.

Near left: The backhoe was used to place the pipe and to pull home the joint.

Price Brothers
CONCRETE PRESSURE PIPE

Man-Made Bristles for Sweeping

PROSTRAN polypropylene man-made bristles are reported to be cutting main broom costs as much as 50 percent and at the same time to be yielding additional savings in terms of reduced down time. Suburban Sweeper Service, Inc., Clifton, N. J., is a typical contract sweeper now using Prostran. They specialize in handling unusual sweeping assignments. Many municipalities in their area call on them for difficult clean up work. In addition, Suburban works for

contractors resurfacing and resealing roads and highways.

Last fall, Suburban installed its first Prostran broom on a sweeper. When this had swept 610 miles under the most rugged conditions, it showed an even wear of only $3\frac{1}{2}$ inches, leaving $3\frac{1}{2}$ to 4 inches of useful sweeping life still remaining.

Recently, in a sweeping assignment on West Orange Mountain, N. J., a Prostran broom performed a clean-up in one day, on a resurfacing job, removing 13 cu. yds. of sand,

dirt and gravel and saving a full day over the original estimate of time required for the work.

In another resurfacing job, the unit worked 31 sweeping miles in 21 hours and removed 168 cubic yards of $\frac{3}{8}$ -in. crack stone. This stone is valued at approximately \$3 per cu. yd. as it is reusable. In still another case, 6 miles of a parking area were swept in 3 hours, removing 21 cu. yds. of sand.

Prostran is available through E. B. & A. C. Whiting Co., Burlington, Vt.



The Soil Density Test

THE SOIL DENSITY test is widely used to determine the degree of compaction of pavement bases and fills. The rubber balloon method for in-place density tests of soils, a proposed ASTM standard specification, is illustrated by this series of photographs prepared by Soiltest, Inc. Equipment shown, the Soiltest "Volumeasure," consists of a calibrated glass cylinder, guard, actuator bulb, rubber balloon and base

plate. Apparatus of this type is restricted to tests of relatively firm, bonded soil masses.

Initially the Volumeasure is placed on the density plate and the liquid filled balloon is forced against the levelled ground surface to obtain a reading. The test hole is then dug using the field density plate as a template. The complete soil sample removed from the hole is retained in a sealed sample container for use

in the weighing and moisture content portions of the test. Next the actuator bulb is used to develop a pressure in the calibrated cylinder, forcing the liquid into the balloon which fills the density hole. A reading is taken when the liquid level in the calibrated glass cylinder reaches equilibrium. The difference between initial and final readings is the volume of the density hole. The soil sample originally obtained from the hole is weighed before and after drying to obtain the moisture content and the dry weight of the material.



● THREE STEPS in the test for determining the density of soil in place by means of the rubber balloon method.

new Federal specification for water pipe

Federal Specification INT. SSP-00385

covers Southern Pipe STEELCOR CEMCOTE Water Pipe...cement-mortar lined and reinforced cement-mortar coated welded steel pressure pipe from 4 to 42 inches in diameter for use in water transmission, distribution, and feeder pipelines

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- complete Federal specification INT. SSP-00385
- Design Tables covering water pressure classes 100 to 400
- Friction Loss Table for nominal pipe diameters (waterways) from 4 to 48 inches and flows from 10 to 100,000 GPM
- a special section on Southern Pipe's exclusive PresSeal Joint with a Deflection Angle table for standard and deep bell PresSeal Joints and an Allowable Radii chart of curvature for various pipe lengths

Get your water pipe answers from a Southern Pipe Sales Engineer....

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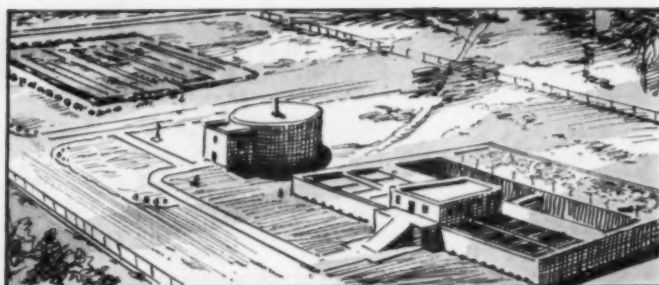
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SOUTHERN PIPE
STEELCOR CEMCOTE
WATER PIPE

THE SEWERAGE AND REFUSE DIGEST



Prepared by ALVIN R. JACOBSON, Ph.D.

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Five Projects In Five Years

The City of Dunbar, W. Va., is pursuing a five-year construction program aimed at solving its sewage collection and treatment problems. This over-all program consisting of five projects will cost about \$1,200,000, these funds being obtained from the sale of revenue bonds, accumulated sewer service charges, and a Federal construction grant. The sewage treatment plant consists of a lift station, pre-aeration and settling basins, chlorine contact basin, digester and digester control building, sludge drying beds, and laboratory and office building. Laboratory control tests are performed using equipment furnished with the Fisher-Hatfield Testing Unit which in effect is a "packaged" lab. The control tests run and records kept include the following: Number of gallons of sewage treated per day; air and sewage temperatures; pH, suspended and settleable solids of raw sewage; suspended and settleable solids of effluent; chlorine—pounds fed and residual; percent settleable solids removed; digester sludge temperature, pH, volatile acids, and gas produced; supernatant volatile acids, grit removed and lime fed to digester. The tests indicate the over-all efficiency of the plant based on BOD varies between 35 and 40 percent.

"Five Projects In Five Years." By Thomas J. Blair, Project Engineer, Kelley, Gidley & Staub, Inc. Consulting Engineers. *Wastes Engineering*, May, 1961.

Algae Growth Rate

This article is a report of an investigation to determine the effect of certain materials, both pure organic compounds and organic matter extracted from sewage, on the

growth rate of an alga, namely *Chlorella pyrenoidosa*, which commonly occurs in stabilization ponds. It was designed to provide information which might indicate if stabilization pond algae do actually assimilate organic matter from waste waters, the growth conditions under which this assimilation might take place, and what effect it would have on algal growth. The technique of testing was to determine the growth rate of *Chlorella pyrenoidosa* grown on an inorganic medium and, at the same time, the growth rate of the alga in cultures to which the test

material has been added. It was concluded: 1) That several types of organic compounds such as sugars, acids, amino acids, and some nitrogenous compounds will accelerate the growth rate of *Chlorella pyrenoidosa* when the rate of photosynthesis is limited by the concentration of carbon dioxide indicating that these compounds may be used as additional carbon sources; 2) some organic nitrogen sources will accelerate the growth rate of *Chlorella pyrenoidosa* above that attained on inorganic media even when carbon dioxide is not limiting;

Dragline Maintains Drainage System



A CONTINUOUS job for the Drainage Department, New Orleans Sewerage and Water Board, is to dredge excess mud out of a series of drainage ditches in East New Orleans, Louisiana. The purpose of these ditches or canals, which are subject to heavy silting, is to carry off heavy rain and flood

waters from a broad area of East New Orleans, channeling the outfall into Lake Pontchartrain. Pictured is the Department's Unit Model 1220 equipped with a $\frac{3}{4}$ -yard dragline bucket. This particular canal is approximately 2½ miles in length with a bottom width of approximately 25 feet.

with a colorful past . . .

Perrysburg, Ohio

plans the future with P.F.T.

The pages of history tell well the story of Perrysburg and the exciting events that took place in and around this "City at the Foot of the Rapids."



Commodore Oliver Hazard Perry

Today, Perrysburg has a population of 5,519 and growing rapidly. Planning for the future and providing for enlarged industrial development, Perrysburg's civic leaders realize that a modern waste treatment facility is a prerequisite to community health and will attract new industry.

FINKBEINER, PETTIS & STROUT, Consulting Engineers of Toledo, were retained by the city and designed the plant shown in the aerial photo below. P.F.T. waste treatment equipment specified for this plant included: Two 35' Floating Covers with P.F.T. Insulated Aluminum Roofing, One P.F.T. #250 Heater and Heat Exchanger Unit, Two P.F.T. Supernatant Selectors and Gauges and P.F.T. Gas Safety Equipment.



Photo Shows P.F.T.'s 35' Floating Covers at Perrysburg.



waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.

4241 RAVENSWOOD AVENUE, CHICAGO 13, ILLINOIS

PORT CHESTER, N. Y. • CHARLOTTE, N. C. • JACKSONVILLE, FLA. • DENVER, COLO.

PUBLIC WORKS for July, 1961

161

BONDSTRAND®

THE "PROBLEM-SOLVER" PIPE



Bondstrand is no ordinary plastic pipe: Made of tension-wound glass filaments, impregnated with chemical-resistant resin—either epoxy or polyester—it is strong as steel . . . yet only one-eighth the weight.

THE PROBLEM

Carbon black slurry destroyed schedule 40 steel pipe in 30 days

Chlorine Dioxide water caused failure in stainless steel pipe

10% Ferric Chloride solution destroyed ordinary steel or stainless

Salt water well injection at 1600 psi

THE LOCATION

Synthetic Rubber Plant

Paper Plant

Sewage Treatment Plant

Petroleum Production

THE SOLUTION

Bondstrand installed 1959. No failure. Performance still rated excellent

Bondstrand installed 1958. Performance still rated excellent

Bondstrand installed 1958. Performance still rated excellent

Bondstrand installed 1958. No failure. Performance still rated excellent

Bondstrand's total installed cost can be actually competitive with ordinary carbon steel pipe. Write for bulletin containing physical and design data.



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Jacksonville, Fla.

6530 Supply Row
Houston, Tex.

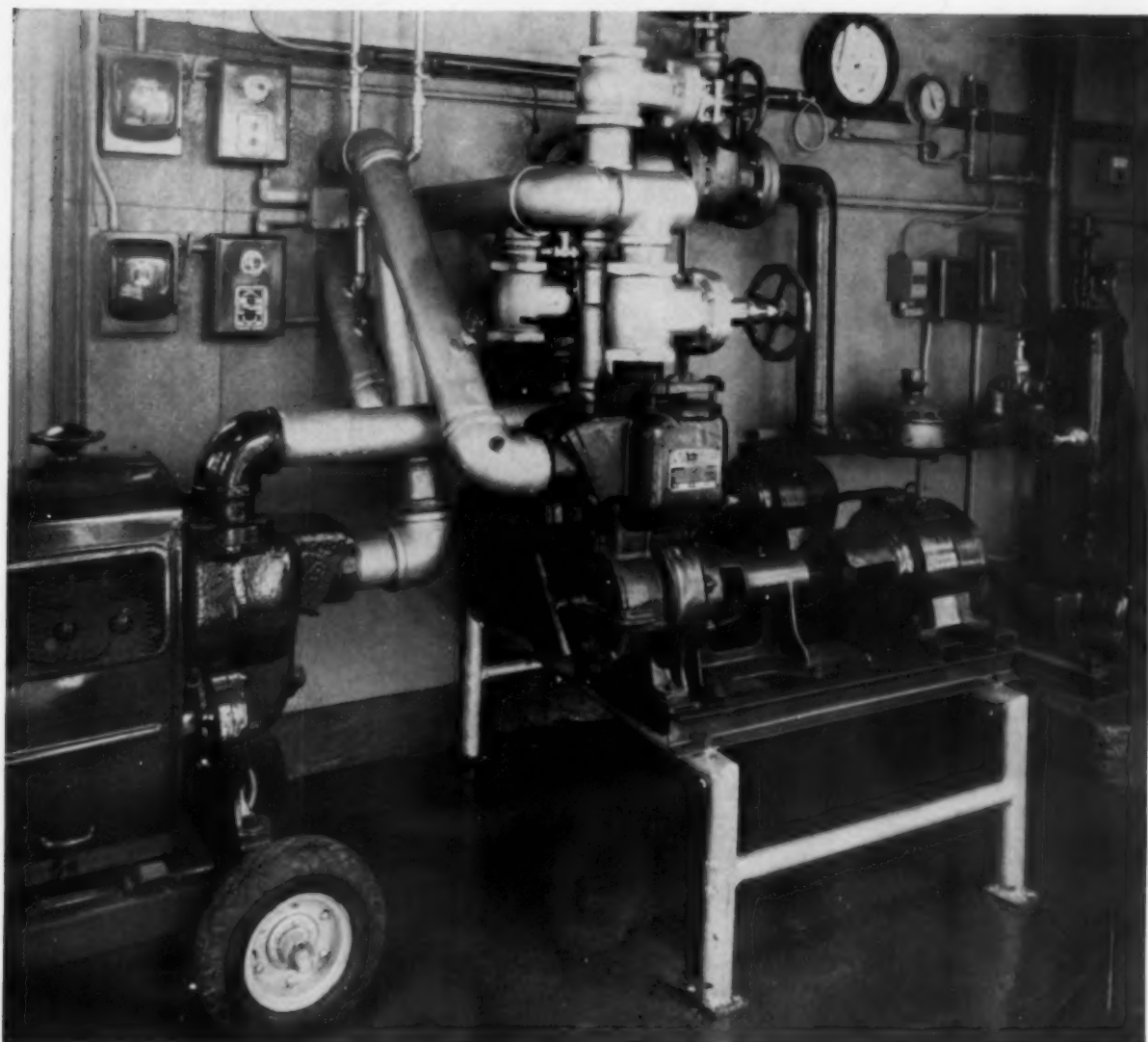
3) some of the organic compounds commonly found dissolved in sewage will accelerate the growth rate of *Chlorella pyrenoidosa* when carbon dioxide is limiting, indicating that some of these compounds may serve as additional carbon sources; 4) some of the organic compounds of sewage will accelerate the growth rate of *Chlorella pyrenoidosa* when adequate carbon dioxide is supplied.

"Algae Growth Rate." By Wesley O. Pipes, Jr., Assistant Prof. of Civil Eng., Northwestern Univ., Evanston, Ill. *Water & Sewage Works*, May, 1961.

Princeton's Treatment Plant

The sewage treatment plant at Princeton, N. J., is presented as a good example of a plant having many of the desirable characteristics necessary to provide good service to a community for a considerable number of years. Equipment and materials of proven quality were used in its construction and the plant was designed so that future additions or expansions may be installed as required by increased population or higher standards of treatment. The original treatment plant, built 30 years ago, consisted of one primary and one secondary sedimentation tank (with hopper bottoms), a one-acre standard rate trickling filter, unheated sludge digestion tanks with no provision for gas collection, a main pumping station, a head house with sludge recirculating pumps, and two glass covered sludge drying beds. In 1954 new additions to the treatment plant were necessary because of new standards set by New Jersey State Health Department. At that time a reinforced concrete secondary sedimentation tank, with mechanized sludge removal apparatus, was constructed. In addition a reinforced concrete circular sludge digestion tank with a floating cover was added. At the same time an open sludge drying bed was constructed. In 1956 three more open sludge drying beds were added. In 1960 two new direct feed V-notch type chlorinators were added for pre- and post-chlorination. Modern automatic equipment will be installed to simplify operations and reduce manpower requirements.

"Treatment Plant Has Long, Useful Life." By Arthur T. Brokaw, Engineer and Director of Public Works, Borough of Princeton, N. J. and Steve M. Slaby, Associate Professor, School of Engineering, Princeton University. *PUBLIC WORKS*, June, 1961.



"8 years, going on 9 - w/out trouble!"

That's GORMAN-RUPP PUMPS for you!

Among other pleasant attributes, Chas. Cusson Ltd., of Montreal, Quebec, is a valued Gorman-Rupp distributor. When they built their building in 1952

(and it's a model of its kind) they put in reliable self-priming, solids-handling Gorman-Rupp pumps for sewage sump operation. And wouldn't you call 9 years of uninterrupted service — without a moment's trouble — pretty fair justification?

As illustrated above, two



Model
14AZ-B
Sewage
Pump

motor-driven pumps are paired on the line. For standby they used an engine-driven pump, solidly piped up. All three pumps are heavy duty. All are self-priming. The regulars are solids-handling, with quick-removable endplates. That means easy cleanout and back on the line again in minutes, not hours or days.

These are the sewage pumps that you can install high and dry. Or, in a dry well, if desired. They're low in first cost, low in installation cost, easy to service and maintain. • Call your Gorman-Rupp Distributor, or write us direct.

2034

THE GORMAN-RUPP COMPANY
305 BOWMAN STREET MANSFIELD, OHIO
Gorman-Rupp of Canada Ltd., St. Thomas, Ontario

Pollution Control Research

Population growths, industrial development, and scientific discovery itself, forecast an unprecedented and almost unpredictable set of demands on water resources. An avalanche of wastes, old and new, will challenge waste treatment technology and water quality control as never before. Present waste treatment and water quality control resources, and their rate of development, do not appear adequate to future needs. The authors have asked a number of pertinent questions that are reasonably straightforward and which can be answered in part. Who is doing research? What research is being done? What are the resources for doing research? Possible courses of action have been suggested. No panacea is offered, because there is none, but it is suggested that those in the profession formally pool their intelligence in a coordinated effort to develop a national program of research. The authors have tossed out the challenge to the Federation to assume real leadership in developing a national research program.

"Where Does Research Stand In

Water Pollution Control?" By H. G. Hanson, Surgeon General and Director of the Robert A. Taft Sanitary Engineering Center of the US-PHS, Cincinnati, O., and Bernard B. Berger, Chief, Water Supply and Pollution Control Research, Robert A. Taft Sanitary Engineering Center. *Journal WPCF.*, May, 1961.

Designed for Industrial Expansion

The City of Mansfield, Ohio, has recently dedicated a newly completed activated sludge treatment plant designed for an estimated 1980 equivalent population of 110,000, including industrial waste flows and with adequate provisions for future expansion. In addition an extensively reinforced sanitary sewer system adequate to serve a connected population of 140,000 was recommended. The sewage treatment plant consists of the following facilities: Mechanically cleaned bar screens; chemical feeders for pH adjustment of raw sewage due to industrial wastes; grit tank; pre-aeration and grease removal tanks; primary settling tanks with surface scum removal devices; aeration tanks which may be operated either as a conventional activated sludge

plant or utilizing the Gould process of step aeration; final settling tanks on which the sludge is removed by rotating suction type collector mechanisms; sludge thickeners; sludge digesters; vacuum filters; air compressors; and essential control equipment, etc. The total program cost of \$8,500,000 was financed by the sale of \$2,300,000 worth of general obligation bonds and by the issuance of \$6,200,000 in sewer revenue bonds. Many industries co-operated wholeheartedly in helping the City of Mansfield solve its waste treatment problems by taking positive steps to decrease the pollutional loads which they were contributing to the city sewers and plant.

"Sewage Treatment Plant Designed for Industrial Expansion." By Floyd G. Browne, Consulting Engineer, Marion, Ohio. — *PUBLIC WORKS*, June, 1961.

Other Articles

"Activated Sludge Process Control." This report points up some of the limitations of the ORP test methods. By Brian L. Goodman, M.S.P.H., Chemist, Sewage Treatment Plant, Warren, Mich. *Water & Sewage Works*, May, 1961.

"Installing a Sewage Lagoon and



*KLEAN-KOTE IS A TRADE-MARK, U. S. PATENT APPLIED FOR. SILVER-GRAY BAND REG. U. S. PAT. OFF.

Over 450 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg Root-Proof Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

Orangeburg's Taperweld Joints seal root-proof and watertight. No leakage, no infiltration. And because it's made of a strong, tough non-metallic material, Orangeburg does not rust. Alternate freezing and thawing... acids and alkalis do not affect it.

All these qualities plus speed, ease and economy of installation have gained for Orangeburg a growing acceptance among leading ap-

proving authorities, architects, engineers, builders and plumbers. Over 450 million feet are in service from Maine to California.

And now, only Orangeburg has exclusive new *klean-kote* protective coating for cleaner, safer handling. The Silver Band identifies *klean-kote* Orangeburg: Root-Proof Pipe for sewer lines; *Perforated* Pipe for foundation drains, septic tank disposal fields. Orangeburg exceeds requirements Federal Spec. SS-P-356 and Commercial Standard CS 116-54.

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Fibre Pipe

Orangeburg Manufacturing Co., Orangeburg, New York, Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products



Consultants, Powell & Powell

White Rock Plant expands again... chooses Jeffrey sludge collectors again

You can't find better proof of equipment than on-the-job performance. Here's the record turned in by Jeffrey sewage treatment equipment at the White Rock Sewage Treatment Plant, Dallas, Texas.

In 1939, sludge collectors for two Jeffrey primary tanks and three secondary tanks were installed. 1948—two Jeffrey mechanical-cleaned bar screens, screenings grinder, two grit collectors, and spiral and scraper collectors were installed.

In 1951, more Jeffrey equipment: mechanical-cleaned screens, belt conveyors, grinders, grit collectors, grit

washer, and sludge collectors for two primary and two secondary tanks.

Now . . . 1961 . . . installation is underway for four new primary tanks and two secondaries equipped with Jeffrey sludge collectors. More examples of the way Jeffrey equipment proves itself again and again.

Jeffrey sanitation engineers can advise you on equipment to suit your conditions. Get your copy of Bulletin 952 describing Jeffrey equipment for water, sewage and industrial waste treatment. Write The Jeffrey Manufacturing Company, 947 North Fourth St., Columbus 16, Ohio.

If it's conveyed, processed or mined, it's a job for Jeffrey.



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BUILD BETTER SEWER LINES



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- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

L. A. WESTON CO.
Adams Mass.

Lift Stations." East Grand Forks, Minn., provides a lesson. By Donald L. Floan, Consulting Engr., Minneapolis, Minn. Water & Sewage Works, May, 1961.

"A Review of the Literature of 1960 on Wastewater and Water Pollution Control." This section of the **Literature Review** covers analytical methods and sewage. By members of the Research Committee of WPCF, H. Heukelekian, Chairman. Journal WPCF, May, 1961.

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Force Account Construction

(Continued from page 119)

In total capital outlay for sewerage utilities the townships, counties and special districts represent 24.7 percent while all municipalities represent 75.3 percent. Of the total for municipalities, the group of over 25,000 population accounted for 49.0 percent, while those with less than 25,000 population accounted for 26.3 percent.

Force-account construction was divided into 26.4 percent for special groups and 73.6 percent for all municipalities (59.9 percent over 25,000 and 13.7 percent under 25,000).

Contract sewerage utilities construction was let at 24.6 percent for special groups and 75.4 percent for all municipalities (48.7 percent over 25,000 and 26.7 percent under 25,000).

Materials and equipment purchases amounted to 23.7 percent by the special groups and 76.3 percent by all municipalities (34.4 percent over 25,000 and 41.9 under 25,000).

The data on hand are insufficient to ascertain the annual variations in these percentages, but it is believed that such annual variations may occur in a marked degree.

Summary And Conclusions

The general trend for force-account construction in both water and sewerage utilities has been an annual increase in dollar volume with very little change in percent of total construction volume. The dollar volume almost doubled for water and increased 75 percent for sewerage during the period studied.

Annual purchases of materials and equipment revealed very little percentage change of total construction volume but did show large dollar increases. Water utility purchases increased almost 128 percent while sewerage utility purchases increased 33 percent for the same period.

It would appear that force-account construction and annual purchases of materials and equipment for publicly owned water and

sewerage utilities are related to total construction and the number of permanent employees.

The relation to total construction is evidenced by the almost uniform percentages represented by annual force-account and purchases for this period. This would indicate that between 10 and 15 percent of water utility construction and about 5 percent of sewerage construction was performed through force-account with permanent employees. These percentages must comprise jobs that do not require higher technical competency and supervision or heavy construction equipment, and are usually scheduled for slack periods. A portion of this type of work is not contracted out by the larger utilities in order that optimum use of employees may be maintained. The slight decline in force-account construction during years of higher than usual capital outlay is probably attributable to a greater percentage of time devoted by permanent personnel to inspection of contract construction.

Permanent personnel of the utilities are generally kept at a minimum by tight budgetary systems. This serves to place a ceiling on type and amount of construction that can be performed by force-account, especially by the smaller water utilities, and an even lower ceiling for the smaller sewerage utilities.

In 1959 there were approximately 129,000 water utility employees and about 56,000 sewage utility employees, which is almost in direct ratio to force-account construction performed in each category.

There is a greater backlog and need for increase in construction of sewage utilities which should result in increased employment. However, it should be borne in mind that fewer employees are necessary for maintenance, repair and operation of sewage utilities than what might be considered to be a comparable water utility. Therefore, it would be reasonable to expect force-account construction in water utilities to continue to exceed that of sewage utilities, although perhaps by a narrower margin.

The important point is that with the present rate of population growth, the pollution problems and the existing backlogs of needed construction, a further increase in rate of construction in water and sewerage is imperative. Contractors and manufacturers of materials and equipment, consequently, can expect a market with a considerably larger dollar volume.

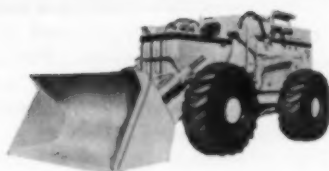
To Make A Works Program More Efficient...

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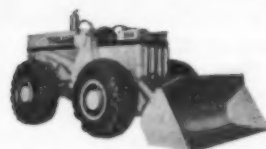
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Designed into the Load-Packer 600 are four exclusive features that substantially reduce operating costs:

The fast, 10-second packing cycle, faster than any competitive unit, allows the engine to run at accelerated speeds up to 30% less than other packers.

The big hopper, largest and lowest of any packing machine, allows fewer packing cycles.

The hydraulic system operates at lower pressures for less strain on the system. And the Load-Packer's exclusive dual-volume pump reduces strain on the drive line by 33%.

The simplified design has fewer moving parts... less to go wrong. And the controls are so simple they are virtually foolproof, even for inexperienced operators.



NEW COMPARTMENTED LOAD-PACKER

allows combustibles and noncombustibles to be handled with one crew, one truck, one trip. Compartmented body keeps materials separated with a watertight seal, allows dumping at different discharge points.



MIAMI BEACH STANDARDIZES ON GAR WOOD LOAD-PACKER

With several million visitors arriving each season, and with a reputation for beauty to maintain, Miami Beach is demanding in its refuse collection requirements. Hotels, restaurants, and business establishments are serviced daily, apartment buildings every two days. The job must be done as fast and efficiently as possible.

To find the best machine for this job, the city tried and tested several competitive packers. The result: Miami Beach chose the Load-Packer exclusively, and now operates a fleet of 33 units.



CITY OF HOUSTON recently filled out its fleet of 29 Gar Wood Load-Packers. Through a lack of dead weight and unexcelled weight distribution, the Load-Packer gives cities the biggest legal loads. Whatever the state restrictions, the Load-Packer hauls more refuse per trip within legal road limits.



RIVERSIDE, CALIF., one of the country's most progressive cities in public works, owns 18 Load-Packers. Combining the fastest operation with the greatest compaction, the Load-Packer offers cities the best service at the lowest cost.



HEMPSTEAD, LONG ISLAND, operates a fleet of 19 Gar Wood Load-Packers. In addition to being the fastest and most efficient packing machine, the Load-Packer is also the easiest to maintain. Its design is a model of simplicity, cutting even routine maintenance to a bare minimum.



SAN DIEGO owns a modern fleet of Gar Wood Load-Packers. With simple, foolproof controls and a low loading height, the Load-Packer

makes the crew's job easier, safer. It's the one packing machine that's tops for crews and public works management alike.

GAR WOOD'S GOT IT!

Major Cities Pick Load-Packer for Bigger Loads, Greater Compaction, Lower Operating Costs



BUFFALO GOES GAR WOOD—BASED ON SOUND EXPERIENCE

After 24 years of experience with refuse collection equipment, Jim Hayes, Motor Equipment Maintenance Superintendent of Buffalo, N.Y., knows the relative merits of packing machines as well as any man. His judgement: "The Gar Wood Load-Packer is the best refuse collection unit made."



Jim Hayes

Hayes is in charge of Buffalo's fleet of 54 Load-Packers. Twenty-six of

these are new Load-Packer 600's. Says Hayes: "I've learned, through experience, that there is a difference in equipment, and that difference shows up in quality—the kind of quality Gar Wood builds into every unit."

The low operating cost of this machine was an important factor behind the city's purchases, as was the excellent service supplied by their Gar Wood distributor.

In Buffalo, as in every other city in which Load-Packers are used, taxpayers are getting the best possible service at the lowest possible cost.

GAR WOOD PAX-ALL CONTAINERS CUT COSTS ON COMMERCIAL ROUTES

Increased speed in refuse collecting means fewer man-hours, lower labor costs, lower operating costs. On commercial routes, Gar Wood's Pax-All Container System offers just that.

The completely hydraulic operation of this system is controlled with one lever. Pax-All containers snap quickly on and off without use of chains or cables. And the Pax-All system is *faster* than the cable method on other packing machines.



WAYNE, MICHIGAN—Gar Wood Industries, world's pioneer in the design and development of refuse collection equipment, has received strong acceptance from major cities across the nation. A few of the thousands of municipalities that maintain fleets of Gar Wood Load-Packers include:

Chicago	Miami
Los Angeles	Birmingham
Philadelphia	Tampa
Detroit	Mobile
Jersey City	Salt Lake City
Boston	Oklahoma City
Baltimore	Cincinnati
Richmond	Atlanta

Part of the reason for this nationwide acceptance is the cost-cutting efficiency of the Load-Packer 600. On a recent independent test, it packed 25-52% more pounds per minute than competitive units. A crew working with a Load-Packer is able to work at least a 10% longer route, and nine Load-Packers can easily do the work of 10 competitive machines. The resultant savings in labor, maintenance, and capital investment are tremendous.

Some cities chose the Load-Packer after making their own independent comparison tests. Others tried competitive packers before standardizing on Gar Wood. All discovered the quality difference in the Load-Packer's superior engineering. And all discovered that Gar Wood's nation-wide sales and service organization is the finest in the industry.

GAR WOOD INDUSTRIES, INC.

Wayne, Michigan • Richmond, California

THE INDUSTRIAL WASTE DIGEST



Prepared by **CLAYTON H. BILLINGS**, Associate Editor

Mathematics of Waste Treatment Plant Design

In order to design a biological oxidation system for a specific organic waste, knowledge is required of the several variables affecting the functioning of the oxidation system. These are BOD removal characteristics under varying conditions, oxygen requirements under different loads, sludge production, nutritional requirements, oxygen transfer rates and ease of solid-liquid separation. These may be determined by standard laboratory tests and pilot procedures. The highly variable nature of pilot plant results on most wastes makes them susceptible to statistical analysis which is desirable for their interpretation and use in process design. The values obtained are rearranged in terms of the frequency of their occurrence, so that an occurrence probability curve may be plotted. The nature of biological treatment requires that provisions be made in design for high chance values, 90 or 95 percent frequency for conditions of pH, oxygen utilization, aeration detention and oxygen transfer characteristics. Variables such as excess sludge and nutrient requirements usually involve consideration of the average value. The rate of BOD removal in the activated sludge process is primarily a function of aeration detention time and sludge solids and is related to sludge growth. Mathematical relationships can be used to define the rate as a zero order reaction (high BOD wastes and specific organic compounds like phenol), a first order reaction (simple compounds in low concentrations) and a retardant reaction (characteristic of complex organic substances such as sewage and paper mill wastes). The composite exponential equation expressing the retardant reaction

considers the wastes as composed of several components, each with a different first order removal rate coefficient. The rate coefficients can be determined from a plot of the logarithm of the percent BOD remaining against the product of average sludge volatile solids and time. Studies must be conducted under a variety of loading conditions to establish the form of BOD removal relationship for a specific waste. Multiple regression analysis can be used to define correlation.

"Designing Biological Oxidation Systems for Industrial Wastes. Part I." By W. Wesley Eckenfelder, Jr., Manhattan College. *Wastes Engineering*, June, 1961.

Determining Chlorine Requirement

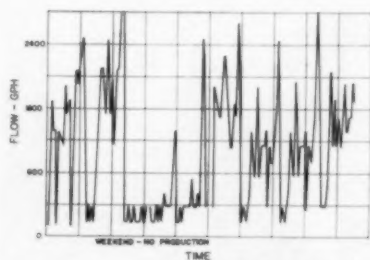
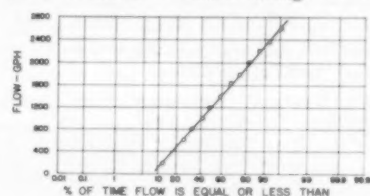
The use of laboratory tests to determine chlorine demand or the chlorine requirement of a waste to establish a predetermined residual is a laborious undertaking. It is

possible to determine the precise endpoint by graphical interpolation or mathematically. In the graphical method, random dosages are plotted against residuals obtained and the curve passing through the endpoint will give the required dosage. The mathematical approach can involve the method of least squares to calculate the curve of best fit. Linear interpolation can also be used by applying the methods of first and second approximations. The latter is slightly more rapid than the graphical method and has the advantage of giving a completely objective interpretation of the data. Comparisons of analytical with graphical and mathematical results showed equal precision.

"Graphical and Mathematical Interpretations for Chlorine Determinations." By M. C. Rand, Syracuse U. and J. V. Hunter and H. E. Orford, Rutgers U. *Journal WPCF*, May, 1961.

Nitriles and Biological Environments

This article reports a continuation of the studies on the behavior of nitriles in biological environments; and on this occasion, in activated sludge and anaerobic digestion systems. Bench-scale units were employed. In the studies on activated sludge, test units received a feed consisting of weak settled sewage containing the test nitrile. Loading varied from 50 to 90 percent nitrile oxygen demand depending on the stage of acclimation, with 70 percent considered normal. The tests were made on aceto, benzo, acrylo, lacto and oxydipropionitrile. It was found that acclimation of activated sludge to the tested nitriles requires a relatively short time; that enzymatic hydrolysis to ammonia followed by nitrification occurs in a manner similar to that in



Courtesy Wastes Engineering

● UPPER curve is an example of how variable pilot data from lower graph is linearized for process design criteria.

Link-Belt's creative answer to a critical sewage problem:

Complete, two-stage bio-filtration in one compact, low-cost unit

BIO-PAC

offers "Big City" sewage processing for the needs of 50 to 500 people

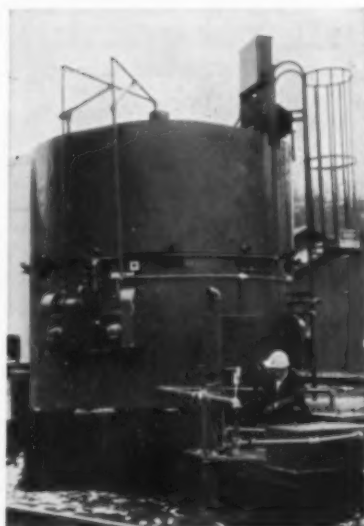
Link-Belt's Bio-Pac brings the economics and efficiencies of "big-city" bio-filtration sewage treatment to areas remote from metropolitan sewerage service. Single units are available to serve 50 to 500 people—perfect for housing developments, trailer courts, motels, shopping centers, industrial plants, schools and institutions.

Bio-Pac literally gives you a functional scaling down of large-volume sewage-plant concepts. Yet, the

"scaled-down" design is a matter of size only . . . no compromise of quality! Each unit is a highly efficient, two-stage bio-filtration system . . . built to meet the Ten State Standards for sewage works.

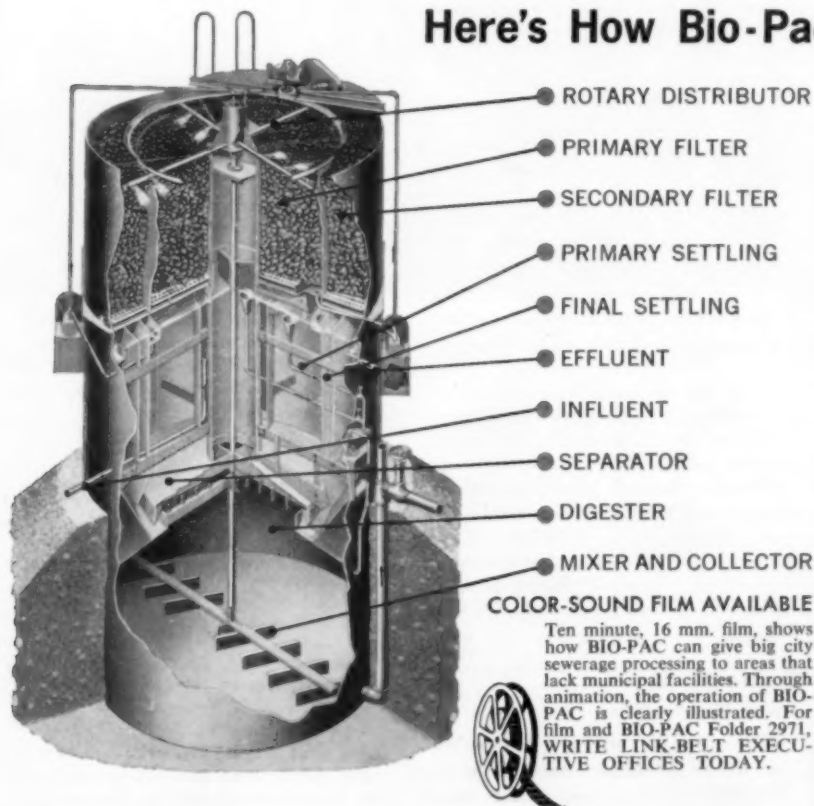
Even under adverse conditions, Bio-Pac produces a consistently stable effluent. It readily absorbs shock loads which frequently upset aeration-type units. And power requirements are much lower than for aerated systems. Important too, Bio-Pac is entirely automatic. Only part-time care is required . . . by personnel who needn't be highly trained.

Because of its exceptional compactness, Bio-Pac can be easily concealed through landscaping and other techniques commonly used in connection with electric service and water storage facilities.



BIO-PAC SEWAGE Treatment Plant for 18,000 G.P.D. flow of sanitary waste. Installed at Houdaille Construction Material Co., Bridgeport Twp., near Bound Brook, New Jersey Plant.

Here's How Bio-Pac Works



Bio-Pac two-stage treatment starts with removal of the settleable solids in a primary settling compartment. Then, sewage is pumped to two bio-filters operating in series, where aerobic bacteria remove 85 to 95% of the suspended solids and B.O.D. (Biochemical Oxygen Demand). The last stage, a final settling compartment, completes the process of producing a stable effluent.

Sludge from both primary and final settling compartments goes into the digester. Disposal of digested sludge can be done on drying beds or by tank truck haul-away about once or twice a year.

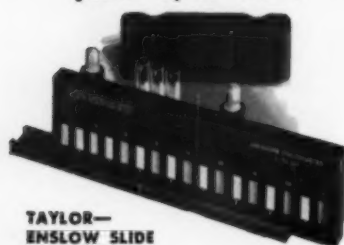
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SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Office—Atlanta, Chicago 9, Colmar, Pa., Kansas City 8, Mo., San Francisco 24. District Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 15,000

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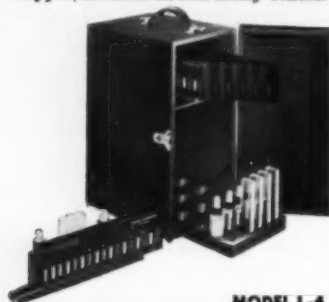
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surface water; that nitrile activated sludges appear resistant to shock loading; that cross acclimation to different nitriles indicates all but lactonitrile to be similar; that nitrate problems in the effluent are more likely to be handled successfully by effluent denitrification than by treatment control to prevent denitrification. Results of the anaerobic digestion study did not recommend this method of treatment; lacto and acrylonitrile were found too toxic.

"Experimental Treatment of Organic Cyanides by Conventional Processes." By F. J. Ludzack, R. B. Schaffer and R. N. Bloomhuff. R. A. Taft Sanitary Engineering Center. *Journal WPCF*, May, 1961.

Radioactive Wastes Disposal at Hanford

During the few years elapsed since the startup of the Hanford plutonium production plant at Richland, Washington, the technology associated with handling radioactive materials has been developed to a stage of proven ability. The investments in facilities and methodology have made Hanford a proving ground for radioactive waste disposal techniques. Air-borne contaminants have been satisfactorily retained by extensive scrubbing and filtration. Ground contamination at Hanford attributable to plant operation is less than that resulting from world-wide fallout. While tank storage as practiced at Hanford for high-level wastes and ground disposal for intermediate level wastes are not considered ultimate solutions, the success with the operations provides assurance that development of power from fissionable materials can progress in an orderly manner for several decades without danger of over-accumulation of liquid wastes. The basis of waste control has been placed at the point of exposure, with operational release confined to each individual process facility.

"Waste Control at the Hanford Plutonium Production Plant." By R. F. Foster, R. L. Junkins and C. E. Linderth, Hanford Laboratories Operation, General Electric Co., Richland, Wash. *Journal WPCF*, May, 1961.

Treatment by Foam Separation

When components of a true solution differ in surface activity, concentration differences occur between the surface layers and the

bulk of the solution. Thus surface active components can be removed by utilizing a stable aqueous foam. Three years ago it was found that inorganic metal ions could be separated from their solutions by foaming. To do this a foaming agent is added which is capable of complexing the desired cations into a surface active form. The process can be made continuous by directing the feed stream containing the metal ion together with sufficient foaming agent to complex it, countercurrent to a rising foam bed. The foam is removed from the top of the bed and the liquid residue, free of the cation, is extracted from the bottom. Multi-column arrangements in series increase the efficiency of the process. Applications suggested are recovery of metals from dilute process waste streams, purification of solutions, extractive metallurgy and refining, and separation of specific radionuclides in nuclear process industries.

"Foam Separation." By H. M. Schoen and G. Mazzella, Radiation Applications, Inc., Long Island City, N. Y. *Industrial Water and Wastes*, May-June, 1961.

Photometric Titration

By arranging a light source and phototube, endpoints of titrations may be detected photometrically. The potential of the phototube output may be measured by any high impedance device such as the dual unit Titrometer made by Precision Scientific Co. The latter apparatus allows one unit of the Titrometer to be used with the photocell and the other for adjusting the pH of solutions prior to titration. The apparatus has been used for titration of calcium and magnesium with EDTA to the murexide and Eriochrome Black T endpoints; and to titration of potassium permanganate with arsenite-nitrite solution and many other titrations involving EDTA.

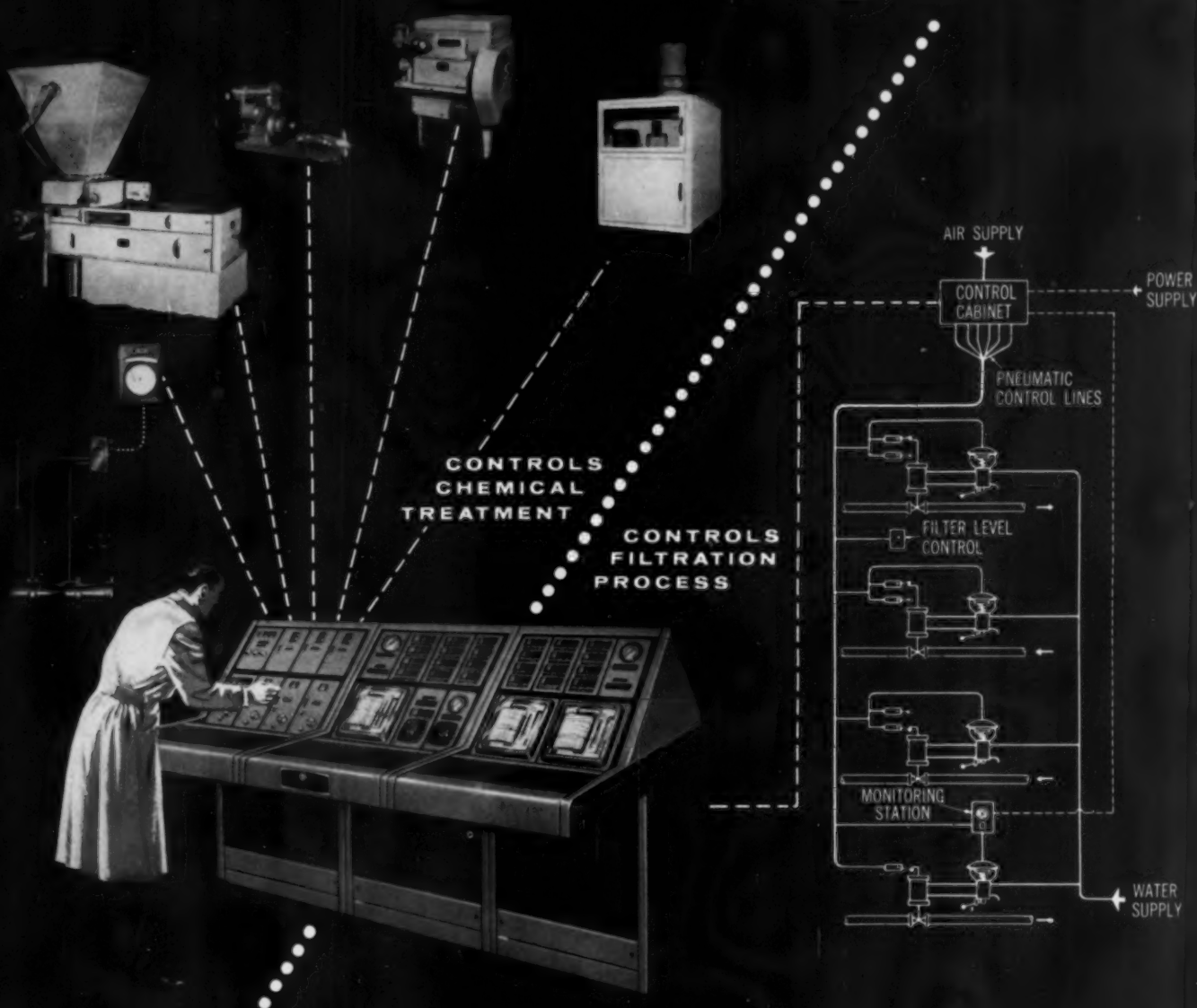
"Simplified Apparatus for Photometric Titration." By E. J. Agazzi and G. W. Bond, Shell Development Co., Emeryville, Calif. *Analytical Chemistry*, June, 1961.

Other Articles

"Recovery and Treatment of Metal Finishing Wastes by Ion Exchange. Part I." By J. C. Hesler, Nalco Chemical Co., Chicago, Ill. In this first of a three part article, general plant practices, survey and evaluation methods are described. *Industrial Water and Wastes*, May-June, 1961.



POSITIVE CONTROL OF MATERIALS FLOW



*New advanced concept! **B-I-F** laboratory control... more efficient water treatment for less money!*

ONE MAN CONTROL — From a single console in laboratory, the best qualified man (the plant chemist or chief operator) now has instant fingertip control over plant throughput, chemical additions, and filter backwash. This simplifies and improves process supervision . . . releases other manpower for more productive assignments.

MORE EFFICIENT FILTRATION — Centralized backwash control automatically initiates washing cycle . . . eliminates over or under washing and upset filter beds . . . allows key-man to make immediate, corrective adjustments over entire filtration and treatment process.

REDUCED COSTS — Overall plant construction costs reduced 15% to 20% by eliminating structures over filters. Chemical feeders located remotely for straight-line process flow . . . protects floc, improves settling, provides longer filter runs.

Remote location of feeders also reduces maintenance cost by removing chemical dust problem from office and laboratory.

ANOTHER B-I-F 1st! — Since the introduction of its Venturi Tube, 74 years ago, B-I-F has continuously developed new products and concepts in the municipal water treatment field. Today Laboratory Control makes your municipal bond dollar go farther by increasing filtration efficiency at lower cost.

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MODIFICATION of Incinerator Precipitator Baffle Saves \$15,000 per Unit

THE CITY of Rochester, New York, has encountered expense due to the loss of precipitator baffle walls in the cleaning chambers of its refuse incinerator. The baffle walls were lasting only about one year. This meant a yearly replacement expenditure of \$18,000 each, times the number of units, plus labor costs and downtime for maintenance. The problem, the city officials felt, was to reduce costs, to eliminate downtime and to increase efficiency.

Originally, incinerator builders and others installed spray chambers to precipitate fly ash and to reduce gases to as low a volume as possible. Later stainless steel baffles of the 310-316 type were installed to promote greater cleaning effect and were reportedly more efficient. However, the moisture in the spray chambers becomes highly acid by "pickup" from the hot gases. In some plants the water used in the spray chambers is not recirculated. In even

a single passage, the water becomes highly acid and the acidity is substantially increased when recirculation is used. The highly acidic moisture reacts severely on the stainless steel baffles and stainless steel water pipes.

Lawrence R. Cook, Superintendent of Incineration for Rochester, developed a plan for modification, using a baffle which is basically firebrick. Mr. Cook brought his problem and his idea to the J. H. France Refractories Company, Snow Shoe, Pa. Considering the gas temperatures and thermal shock, the firm recommended a low porosity, low density Rockspar P-4 brand Super Duty Fire Brick as the type of brick to do the job. These brick were substituted for the vertical stainless steel baffle plates. They were manufactured in a special shape 9"x6"x3" in size with a 2"x3/4" slot for the stainless steel retaining rod. A tongue and groove

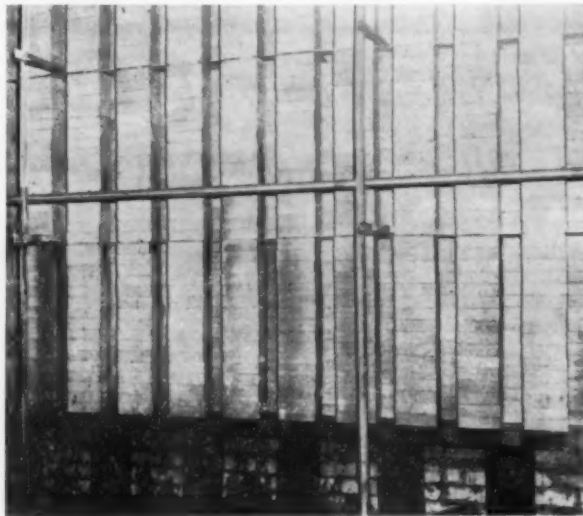
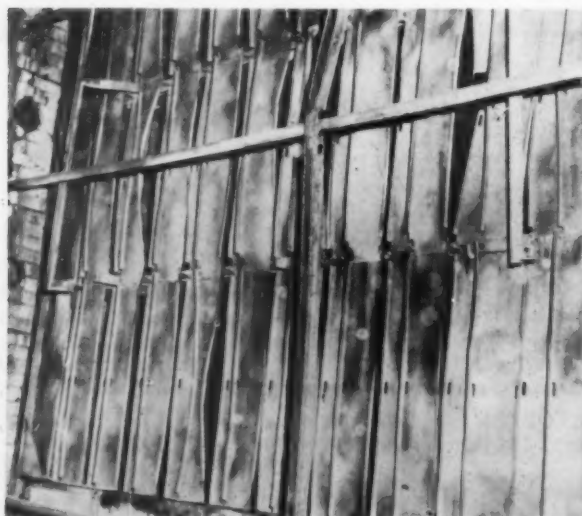
on the brick assures that they will stay in position.

The brick were set on the starting plate and inserted on a vertical rod. In constructing the first baffle they were laid up dry, sixteen brick high and levelled off with a fine grind refractory castable. A stainless steel plate was then dropped in place, brick were once again laid sixteen high and the procedure was repeated to the roof level where the baffle fitted into a protective plate in the roof.

A refractory castable is a hydraulic setting cement which takes an air set upon the addition of water, similar to portland cement except that a refractory base material is used, to withstand high temperatures. Attaining various degrees of temperature resistance are possible by varying the mix.


A second baffle was later constructed in much the same manner except that the brick were laid ten high. This change was made because it made possible better control of the baffle level between stainless steel plates during construction.

The first baffle had a completed cost of approximately \$3,000, including labor. An immediate budget saving of \$15,000 resulted. When the third unit goes in, a saving of at least \$45,000 per year will be realized and more is expected since the installations show evidence of giving much longer service. Translated in terms of incineration, this could mean more efficiency, less replacement labor and substantial incineration budget reductions. Translated in terms of the average taxpayer, it reflects more efficient use of his tax dollars.



Photos courtesy City of Rochester, New York.

● SEVERE service conditions in Rochester incinerator warped original baffle; modified baffle of brick was not affected.



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Many sewage treatment plants can now get all the advantages of clarification and separate thickening facilities without the expense of adding a sludge thickening unit to the treatment system.

New Eimco-Process Clari-Thickener treatment unit combines primary or secondary clarification and sludge thickening in a single multi-purpose unit. Sludge densities of 8 to 12 per cent solids are obtained. Clarification efficiency is excellent. Complete control of septicity is achieved.

The Eimco-Process Clari-Thickener unit incorporates a separate thickening compartment within the clarification section for holding settled sludge 12 to 24

hours for thickening to maximum density.

Septic conditions are prevented by the introduction of an oxidative liquid which forms a blanket zone over the thickening compartment during holding periods. This liquid displaces the liquid in the sludge, keeping solids fresh. The amount of oxidative liquid introduced can be adjusted to suit operating conditions.

Find out how the Eimco-Process Clari-Thickener unit can help you get greatly improved treatment, economically. The Eimco-Process representative in your area will be glad to meet with you and your engineers. Call him. And write Eimco's Process Engineers Division for new Bulletin SM-1018.

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Prestressing with **USS** American High Tensile Grade Wire adds strength and durability to 11,000 ft. of 36" concrete pressure pipe installed along Cincinnati main artery

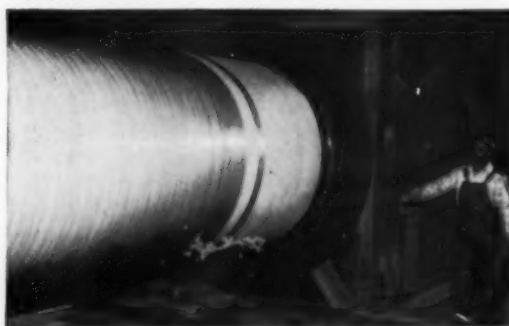
Cincinnati's Montgomery Road is one of the busiest streets in town. It feeds main line traffic into Cincinnati from the Northeast. Recently the city faced the problem of extending a 36" water line 11,000 ft. down Montgomery Road. The job had to be done fast. The road had to be kept open. The answer was Concrete Pressure Pipe prestressed with USS AMERICAN Bright-Drawn High Tensile Grade Wire. A special steel-and-rubber joint which is made quickly and easily sealed adjacent ends of the pipe.

According to contractor A. F. Jelen & Son Company, Cincinnati, the special joint allowed them to lay the pipe without a hitch, and the job was finished right on schedule. Furthermore, the joint remains bottle-tight under the heaviest traffic loads.

The prestressed steel-and-concrete pressure pipe for the Cincinnati job was manufactured by Price Brothers Company, Dayton, Ohio. It's made by forming a steel plate into a cylinder. The seam is welded and the pipe undergoes a high-pressure hydrostatic test to make certain the weld is tight. The inside of the cylinder is then covered with a layer of centrifugally cast concrete and the cylinder, with its concrete core, is wrapped with a helix of USS AMERICAN Bright-Drawn High Tensile Grade Wire made to ASTM specification A-227. After wrapping, the entire pipe is covered with mortar to protect the wire

from corrosion. Tension in the wire places the concrete and steel cylindrical shell in compression. In service, the internal pressure caused by the liquid acts to overcome this pressure. Thousands of miles of this and other types of prestressed concrete pipe have been installed across the country.

USS American Steel and Wire Division pioneered the making of high tensile strength steels for prestressed concrete construction. And we are constantly working with manufacturers to make sure they get the wire they need to keep the quality of their product high. Get the complete story in our free 56-page brochure: *USS American Wire and Strand for Prestressed Concrete*. Write today: American Steel and Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio. USS and American are registered trademarks

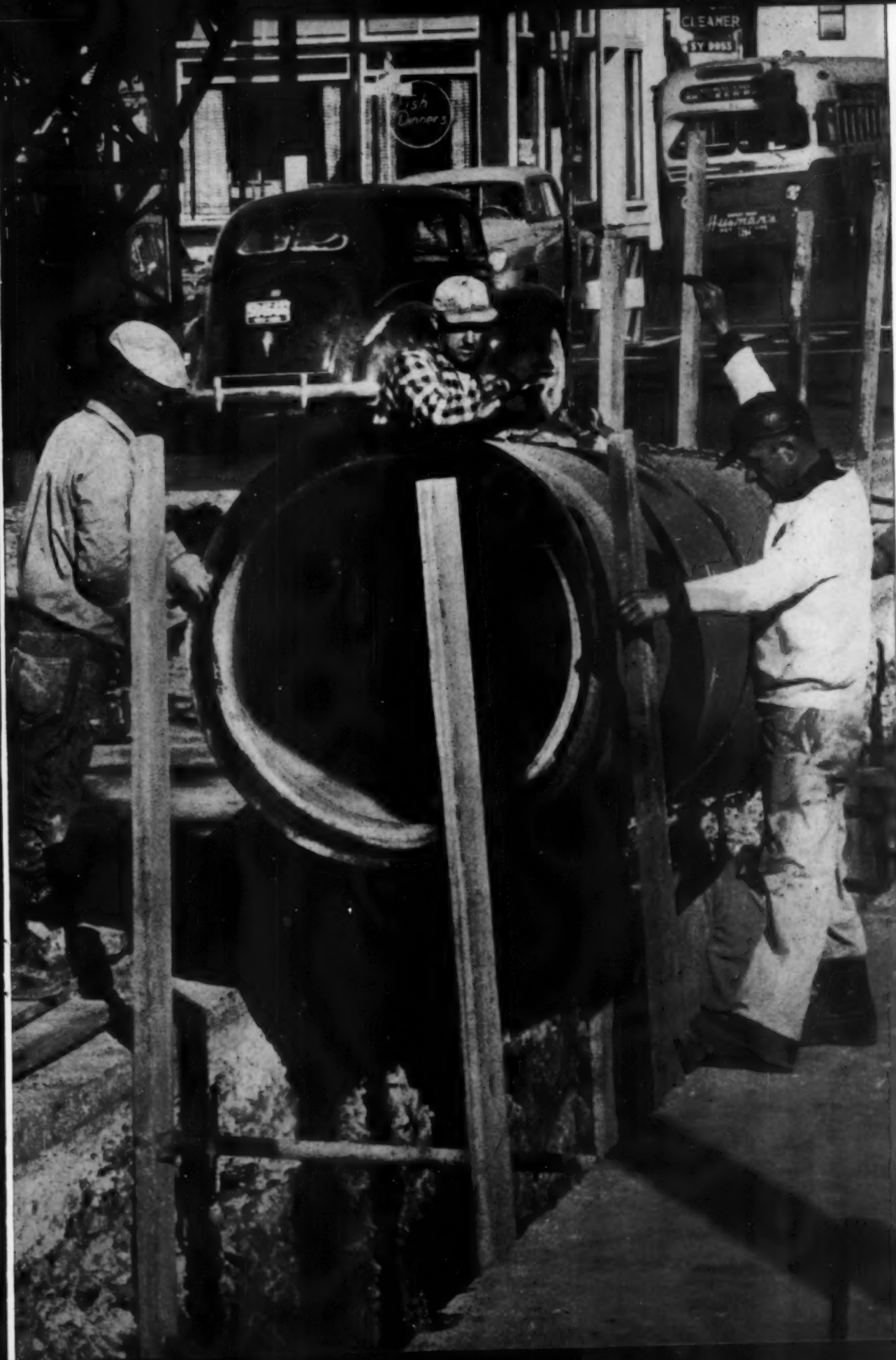


Steel cylinder, with concrete core, wrapped with USS AMERICAN High Strength Wire. Wire is then covered with mortar coating.



**American Steel and Wire
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INSULATION CO-ORDINATION

BRUCE J. ENNIS

Associate,

Burns & McDonnell Engineering Co.,
Kansas City, Missouri

A BOLT of lightning, rising to a crest of millions of volts in a few micro-seconds, and producing currents up to 200,000 amperes, is no respecter of circuits. It is as apt to strike a 2.4 kv feeder pole line to a pumping station as it is to strike a 161 kv tower line feeding an atomic energy gaseous diffusion plant. In either event, the damage to improperly protected equipment could be disastrous, resulting in loss of water supply for a community from a burned out pump motor, or necessitating the shutting down of a huge complex due to failure of a substation power transformer.

In effect, such a lightning surge could arc across a whole string of insulators suspended from a steel tower as well as it could jump across a pin insulator mounted on a wood cross arm, unless the design of the 2.4 kv and 161 kv circuits and their connected equipment were properly correlated with the characteristics of protective devices through suitable insulation co-ordination.

Protective devices such as lightning arresters, protector tubes, and gaps are designed to flash over and drain excessive overvoltages from circuits to ground. Electrical equipment requiring protection includes transformers, circuit breakers, line and bus support insulators, generators, motors, and the like. Insulation co-ordination is the selection of insulation having an impulse strength in excess of the voltage levels to which a given circuit may be limited by the action of protective devices.

In modern practice, equipment insulation is tested with surge generators and test gaps which produce a $1\frac{1}{2} \times 40$ micro-second impulse testing wave (which simulates severe lightning surges). This value means that the impulse wave put out by the surge generator rises to a full crest value in $1\frac{1}{2}$ micro-sec-

onds, and decays to half value in 40 micro-seconds. Industry standards require the testing of power class equipment with such impulse crest voltages equal to or in excess of the following basic impulse insulation levels (figures shown in parentheses are for distribution type equipment):

Reference Class kv	Basic Impulse Level kv
1.2	45 (30)
2.5	60 (45)
5.0	75 (60)
15.0	110 (95)
23	150
34.5	200
46	250
69	350
115	550
138	650
161	750

To illustrate the application of insulation co-ordination, let us assume that a 1,000 kva, 15 kva substation transformer is to be protected against excessive overvoltages. Such a transformer will be designed, insulated, and tested by the manufacturer to withstand an impulse test voltage of 110 kv. If a 15 kv distribution valve type lightning arrester is to be used for protection, the arrester will have an impulse spark over approximately 91 kv and a discharge voltage at 20,000 amperes of about 99 kv, both of which are lower than the withstand insulation level of 110 kv built into the transformer. If a 15 kv station type lightning arrester were used, the corresponding spark over and discharge voltages would be only in the order of 61 kv and 65 kv, respectively, affording greater protection for the transformer insulation.

The spark over voltage of such an arrester is affected by the rate of voltage rise of the incoming traveling wave, and its discharge voltage depends on the magnitude and rate of rise of the surge current. The protection afforded by the lightning arrester will be greatest when it is placed as close as possible to the transformer being protected.

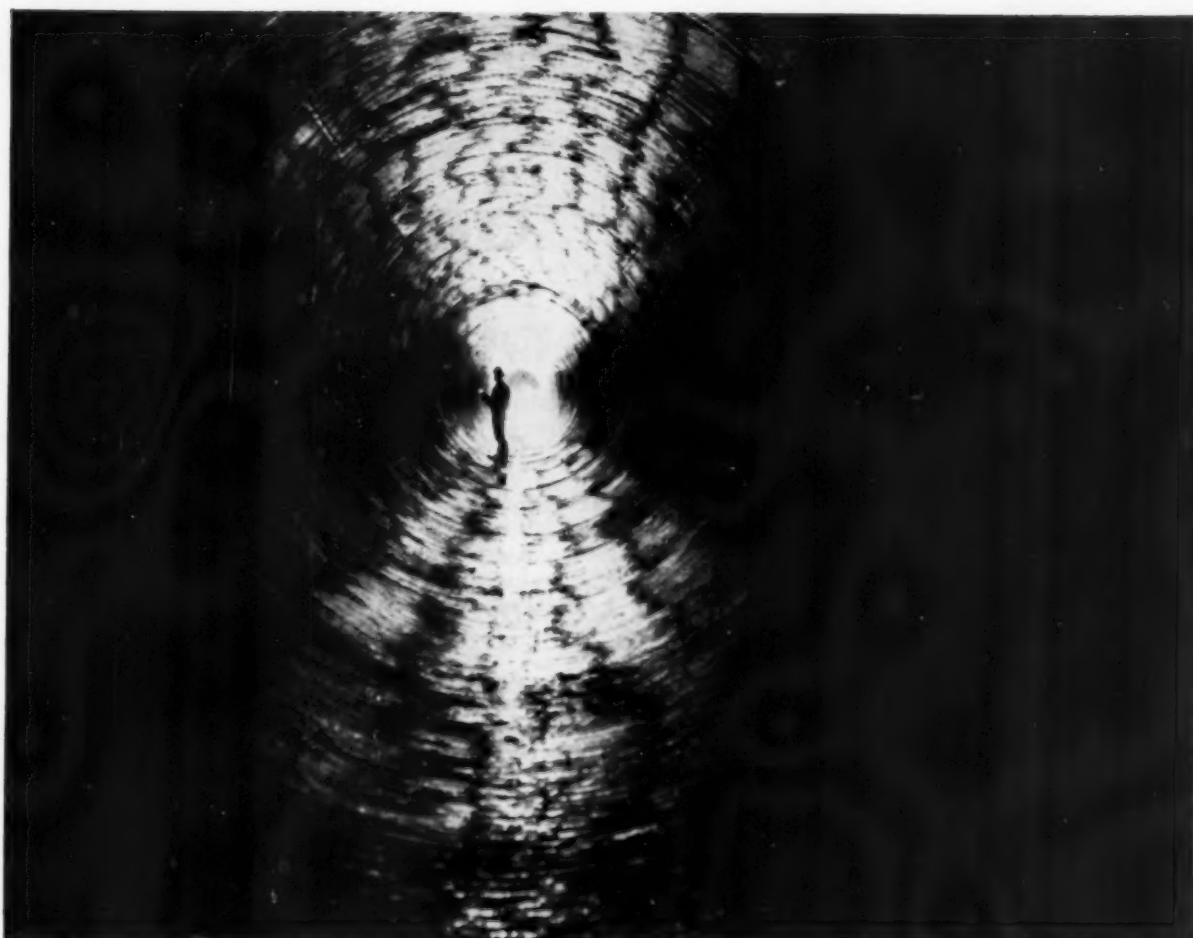
When a traveling wave reaches the substation's lightning arrester, its magnitude is limited to the discharge voltage of the arrester; however, the wave continues on past the arrester at the same rate of rise as the initial incoming wave until it strikes the transformer. There it builds up and is reflected back at twice the original rate of rise. If the distance between the arrester and the transformer is great enough, the voltage build-up at the transformer will be nearly double the discharge voltage of the arrester. On the other hand, if the arrester is located directly at the transformer (requiring "zero" micro-seconds for the reflected wave to reach the arrester) the surge voltage at the transformer will be limited to the discharge voltage of the lightning arrester.

If the distance between the lightning arrester and the transformer is 100 feet, it will require 0.1 micro-seconds for the wave to reach the transformer after passing the arrester, and another 0.1 micro-second for the reflected wave to reach back to the arrester.

If the initial incoming wave has a rate of rise of, say, 300 kv per micro-second, the voltage at the transformer could be 60 kv above the discharge voltage of the arrester due to the first reflection of the traveling wave, but with a maximum value not in excess of twice the arrester discharge voltage.

To protect against lightning striking an incoming line near the substation, with resultant high rates of voltage rise and high surge currents, overhead ground wires should be provided to shield the aerial conductors. In addition, lightning arresters or protector tubes, installed out on the line at some distance from the substation, will limit the magnitude of surges reaching the station. The inductance of the line between the outlying arresters and the substation, acting with the capacitance of station equipment, has the effect of reducing the slope of the traveling wave front.

Rotating machinery, such as motors and generators, has a lower in-



An engineer of Quebec's Hydro-Electric Commission examines the Bitumastic coatings inside the huge Bersimus penstocks.

Bitumastic lining stands up like new in high pressure penstock service

The most critical points in the giant Bersimus River penstocks are the eight 328-foot steel pipe sections, located immediately below the elbows, where water pressure reaches 540 pounds per sq inch. Quebec Hydro-Electric Commission engineers picked Bitumastic coal-tar enamel for the protection of the steel pipe in this tough service.

The coatings applied to this section had to meet very stringent requirements: first, the high moisture content inside the penstocks made it necessary to use a very fast drying primer to protect the coating's bonding action from moisture attack. This requirement was fully met by Bitumastic Jet-Set Primer, the fast-drying primer with a bond estimated to be five times stronger than other primers.

Two coatings of Bitumastic No. 70-B AWWA Enamel were applied to meet the other requirement: these top coatings will have to provide a minimum of five years maintenance free service. A recent over-all inspection of the line indicated that the coatings are still in excellent condition and should last 40 years or more, based on previous experience.

Koppers coal-tar protective coatings are ideally suited for severe corrosion conditions where water resistance and maintenance free service are mandatory. For more information on how Bitumastic coatings can solve your corrosion problems, mail the coupon or write: Koppers Company, Inc.,

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sulation level than other equipment, such as oil immersed transformers. Stress on the insulation between turns in the windings depends on the steepness of the traveling wave front. The higher the rate of rise of the surge voltage, the higher will be the stress on the insulation between the turns. Stress on the insulation between the windings and the motor or generator frame, on the other hand, depends on the line to ground magnitude of the traveling wave voltage. Consequently, to provide adequate protection for rotating machines (which cannot be over-insulated due to space limitations, and which cannot be of oil-immersed construction), it is necessary: (1) to apply special lightning arresters, to limit the magnitude of surge voltages and thus protect the insulation between the frame and the windings; and (2), to apply shunt capacitors at the machine terminals, which operate in conjunction with the series reactance of the incoming line circuits to reduce the rate of voltage rise of the traveling wave and relieve the stress on the insulation between turns of the windings.

Variable Speed Pumping (Continued from page 95)

justified assumption since, as it was seen before, this curve roughly bisects the range of usual operating conditions, and, in the case of the two types of variable speed drives, any errors introduced by this assumption should cancel out, when the relative economics of the two drives are compared.

The operating records which are so far available were analyzed and they indicate an average pumping rate of 2,100 gpm with average pump operation of 3,300 hours annually. The cost of electric power is approximately 2.5¢ per kwh. Based on these data, and on the curves in Figure 3, the relative power costs for the three methods would be as follows:

Method	Power	
	Approx. Input	Approx. Cost
Throttling	78 kw	\$6,400/yr.
Wound rotor motors	47 kw	3,900/yr.
AC/DC drives	35 kw	2,900/yr.

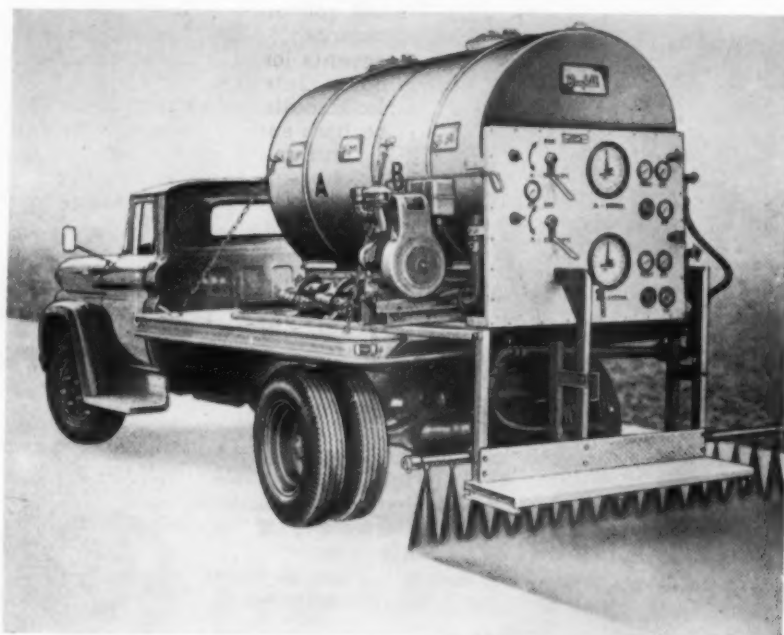
It can readily be appreciated that the saving in operating cost, which can in many installations be very considerable, will often justify variable speed drives of one type or

another on a strict unit for unit comparison. Where adjustable speed drives are used, however, fewer units are generally required. Also, where an open suction well is required, the close control of the pumping rate possible with the speed control permits a considerable reduction in the suction well capacity. Savings made in the overall project cost, owing to the use of fewer units and of a smaller structure will, on many projects, more than offset the higher initial cost of adjustable speed drives and the related control. Especially in the case of sewage lift stations which generally require deep and very expensive structures, the savings resulting from the use of variable speed pumps can be very substantial indeed. In the case of the Park Street pumping station, alternate bids were taken on the AC/DC drive

and on wound-rotor motors with equivalent controls and a saving of \$8,000 was effected by the selection of the AC/DC drives. Thus a double saving in both first cost and operating cost was achieved in this particular installation.

Next to the electric motor, a centrifugal pump is perhaps the most widely used machine in a variety of applications, both in the industry and in public works installations. Skyrocketing water consumption and rapidly increasing stream pollution will demand a greatly stepped-up future program of public and private construction in the fields of water works and sewage and industrial wastes treatment. The excellent operating records being accumulated by a number of installations with variable speed pumps indicate a greater use of this equipment in future installations.

EPOXY RESIN PAVER



A COMPLETELY automatic Epoxy Resin Paver, owned by Sentinelkote Corp., 3015 N. California Ave., Chicago, accurately mixes and dispenses up to 40 gallons of epoxy resin per minute. This unit, equipped with two 500 gal. tanks and 14 foot spray bar has been used successfully in Kansas and other areas to apply over 17,000 square yards of bridge deck sealant and wearing surface. It will apply over 3,000 square yards of epoxy resin in less than twenty minutes.

The unit stores the epoxy resin components in portable tanks which permit the application of 40,000 sq. ft. without refilling. The two components are proportioned and blended uniformly and sprayed onto the road surface. Employing a self-contained cleaning system, the unit thoroughly flushes with solvent, those portions of the equipment which are exposed to the mixed components, thus preventing build-up of deposits that might interfere with proper functioning.

How six Iowa counties cut compaction and rolling costs



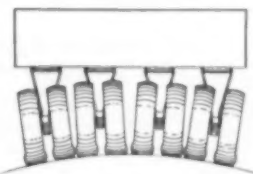
Compacting base for street extension with 10-30 RD dump body Duo-Pactor.

When a county in Iowa bought a Seaman Duo-Pactor, word soon got around among highway officials in neighboring counties. They came to watch, went home to buy this rugged, versatile compactor. In short order, six counties, one of Iowa's largest cities, and a contractor purchased Duo-Pactors. One engineer, in his annual report, described his Duo-Pactor as most efficient in rough and rugged grading or surface finishing.

Key to Duo-Pactor versatility with high efficiency is Duo-Paction. It provides both pneumatic compaction for depth, and steel for surface rolling and to press down the ridges for density uniformity over the entire rolling width, as shown below:

This principle of alternate rolling with rubber and steel—Duo-Paction—applies equally to consolidation of fills and embankments, and to subbase and base materials. Final passes with the steel roll on subgrades provides a smooth, dense surface which prevents loss of subbase or base course materials by embedment; also smooths, levels, and densifies the base surface for seal coating or bituminous mat. Uniformity of subbase and base thickness is easily maintained.

For the ever-present maintenance jobs such as repairing chuck holes, frost boils, etc., the Duo-Pactor's rubber tires compact cold or hot mix under compactive force exceeding that of



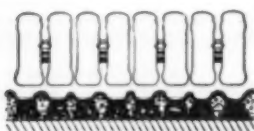
Spring mounting of tires in pairs provides vertical travel and controlled oscillation. Pressure is uniform over the entire rolling width regardless of surface irregularity.

tires on heavily loaded trucks. The steel roll then is lowered to iron the patch smooth and level with the surrounding surface.

Using the rubber roll on seal coating, the Duo-Pactor provides working speeds up to 10 mph. The closely spaced rubber tires press in the chips. Chips embedded while the bitumen is hot remain as an integral part of the road surface. *Note:* Auto traffic comes too late for chip embedment and does not roll in the chips at center or sides of the roadway.

The job done, simply dump ballast and drive to the next job; also carry tools, supplies, or materials.

This is Duo-Paction:



The closely spaced tires form densely compacted tracks or ruts, with minimum material displacement. However, rubber tires will leave ridges between ruts...



Lowering the steel roll applies tremendous pressures to the ridged material, choking it down between the tire tracks, thus unifying density across the entire rolling width.

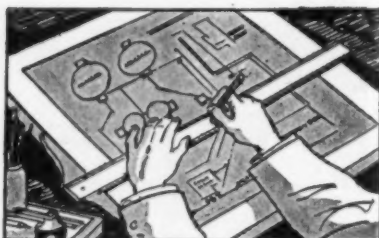
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Urban Mapping*(Continued from page 117)*

These boundary line maps can then be readily and accurately updated and extended into newly developing areas, since all new land subdivision plats must, by law, be tied to corners established in the Public Land Survey. The accuracy of these plats can be readily controlled by local subdivision regulations.

The system provides a common control for both topographic and boundary line maps. By relocating the U. S. Public Land Survey corners and accurately placing them on the State Plane Coordinate System, it becomes at once possible to prevent the future loss of these corners and to accurately correlate property boundary line information with topographic details supplied by aerial mapping. This placing of property boundary and topographic data on a common datum is essential to sound urban mapping and to proper municipal engineering practice. Great savings in office research time are possible during the planning and design phases of municipal public works projects by having all available information on one map. Moreover, such complete information and control make possible the consideration and analysis of many alternate routes for such works as trunk sewers, water transmission lines and major trafficways.

The system offers an extremely practical horizontal control network readily usable by both private and public surveyors and engineers for all subsequent survey work. The control system outlined places a monumented, recoverable control station of known position on both the public land survey and state plane coordinate systems, and of known elevation at half-mile intervals throughout the urban area. This monumented control net expedites engineering surveys made almost daily by such public works agencies as city engineering and water departments; county and state highway departments and sewerage, expressway, airport and harbor commissions for planning, design and construction layout purposes. It also correlates and coordinates all of their survey work throughout the entire urban area. The control system is particularly valuable in providing for the precise location and mapping of underground utilities, both public and private.

For the first time, the system makes the State Plane Coordinate System practically available for property boundary survey control,

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thus preparing the way for the ultimate use of State Plane Coordinates in boundary descriptions. The fact that the control system requires the permanent monumentation of the Public Land Survey corners does much in itself to stabilize real property boundaries and makes the control net of great value to private land surveyors. By relocating and adequately monumenting the Public Land Survey corners and then accurately and precisely placing them on the State Plane Coordinate System local land surveyors will, without changing their methods of operation or incurring any additional expense, be able to "automatically" tie all of their surveys to the State Plane Coordinate System, and all bearings used in land surveys, plats and legal descriptions will be directly referenced to grid North and, thereby to true North. Only by making State Plane Coordinates available to the surveyor through the Public Land Survey System, which he understands and employs constantly, can their use in property descriptions be practically achieved.

Through the use of the control system lines drawn on the city maps can be accurately and precisely reproduced upon the ground at the time of plan implementation or construction. When it is realized that the cost of control surveys can account for from one-quarter to one-third of the total cost of the finished maps, and when it is further realized that this control is often unrecoverable and unusable by local engineers and surveyors, the real economy of utilizing a control system such as outlined herein becomes apparent. By allocating to the control survey work a relatively small additional amount of the total resources that might be available for mapping, the city engineer can obtain more effective and useful finished maps and can provide a valuable and permanently useful system of survey control. In the case of the Madison project the only increase in cost assignable to the control system was that of relocation and monumentation of the land survey corners and the additional traversing required to co-ordinate these corners. This amounted to approximately 20 percent of the total cost of the project, a very small increase when weighed against the benefits to be derived.

It is believed that the unique system devised for Madison deserves further study by engineers as it may have widespread application in the Public Land Survey States.

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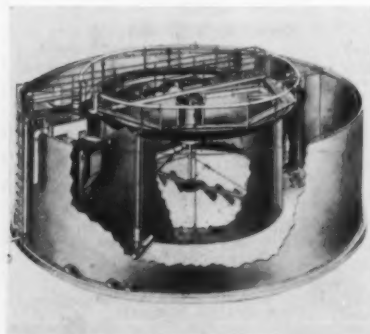
including trailers, sprayers, drags and rollers. The Model V has a long wheel base but short turning radius, hydraulic brakes and a maximum safe speed on smooth highways of 40 mph. Optional equipment includes: power steering, power take-off, hydraulic kit, variable speed governor, rear platform extension, horn, directional signals, and headlights and tail lights.

Toro Mfg. Corp., Minneapolis, Minn.

Circle No. 7-1 on the convenient reply card facing page 34.

Compact Plant

A sewage treatment plant, the Model R "Oxigest," is available in 17 sizes designed to be field-erected at the job site. The units will be fab-



ricated in sizes from 30,000 to 500,000 gal. per day to serve small communities, subdivisions and other facilities from 300 to 5,000 persons. Smith & Loveless will supply, assemble and erect the units on the purchaser's foundation with all material and equipment necessary for a complete, ready-to-operate sewage treatment facility. Under normal conditions, the purchaser will be responsible for the excavation, foundation slab, backfilling, inlet and outlet sewer connections and power supply to the electrical control panel.

Smith & Loveless, Division-Union Tank Car Co., Lenexa, Kans.

Circle No. 7-2 on the convenient reply card facing page 34.

Pocket Radio

This pocket-sized, all-transistor, two-way, Citizens Band radio can transmit up to two miles over land and up to five miles over water. It can receive signals from even greater distances. The "Ray-ette" radio should find many uses among law enforcement agencies, civil defense groups, surveying teams, construction workers and all others with needs for two-way personalized communications.

Raytheon Co., Lexington 73, Mass.
Circle No. 7-3 on the convenient reply card facing page 34.

Auger Drill

The No. 26100 portable auger-drill can auger or drill in soil, gravel, steel, masonry, wood, concrete, ice, etc. A 2½ hp. two-cycle engine with recoil starter and diaphragm carburetor makes the unit operable in either a vertical or angled position. Maximum torque and adequate rpm permit a single operator to drill or auger holes from 1½" to 9".

General Metals Corp., Watertown, Wisconsin.

Circle No. 7-4 on the convenient reply card facing page 34.





Television System

This television system for the inspection of sewers, water lines, conduits, wells, oil lines, gas lines, water tanks, etc., is water tight and furnished complete with an enclosed lighting system, 500 or 1100 feet of cable, and generator. The system is capable of being pulled through pipelines as small as 4" in diameter and as large as 48" in diameter.

Inspectoline Inc., 9501 Euclid Ave., Cleveland 6, Ohio.

Circle No. 7-5 on the convenient reply card facing page 34.

Joint Sealant

A polyurethane joint sealant has been developed which provides resistance to wear, traffic and the penetration of foreign matter. Pro-Seal 962 is designed for sealing highway, bridge, sidewalk and aircraft runway joints. Supplied in two components, the sealant, when properly mixed, cures in place to form a permanently flexible, self-leveling, elastomeric joint. When used with primers recommended by the manufacturer, the sealant develops a high degree of adhesion to most surfaces and possesses other physical and chemical properties required of a superior joint sealant. It is available in pourable form in three variations: fast curing; regular curing and ultra-fast curing (for gun application). The cured compound has a negligible cold flow and compres-

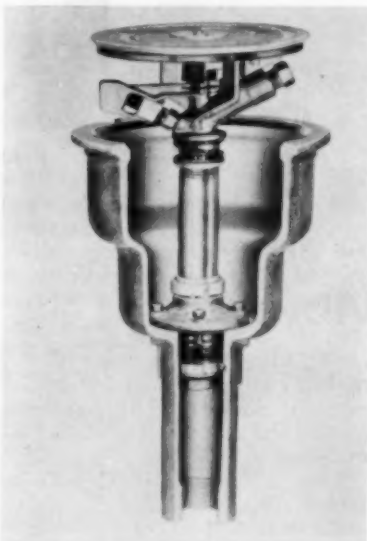
sion set and is unaffected by normal temperature variations.

Coast Pro-Seal and Mfg. Co., 2235 Beverly Blvd., Los Angeles 57, Calif.

Circle No. 7-6 on the convenient reply card facing page 34.

Turf Sprinkler

A line of concealed turf sprinklers, the Rotor Pop-Ups, for use on automatic or manual controlled underground systems on large turf areas, are available in part or full circle sprinklers. The full circle models are available with single or two-nozzle sprinklers. Rubber covered models are made for use on athletic fields and playgrounds for player protection. Sprinklers are designed to be installed flush with the ground so there is no hole to trip those walking or working on the turf. A heavy duty retractor



spring on the sliding pop-up member assures positive closing of the sprinkler when the pressure is off and, for ease of maintenance, the entire internal assembly is removable from the top without removing the case from the riser.

National Rain Bird Sales & Engineering Corporation, Azusa, California.

Circle No. 7-7 on the convenient reply card facing page 34.

Trencher

A Jack-Leg Ditch Witch trencher, available in 9-hp and 12-hp sizes and mounted on rubber tires, has been developed primarily for use in the installation of underground



street lighting cables where it is desirable to trench the cable close to the curb. The jack on the trencher wheel may be installed on either side of the machine, allowing the spoil to be deposited either on the street side of the trench or on the parking side of the trench. The jack is so installed on the trencher that one wheel may be lowered as much as 12" and the machine may be maintained on a vertical plane while the wheels are driving on two different levels.

Witch Marketing Co., Box 249, Perry, Okla.

Circle No. 7-8 on the convenient reply card facing page 34.

Cationic Emulsion

A cationic emulsion, Bitumuls SM-K, is capable of being mixed with dry or damp aggregates, possesses high adhesion to siliceous aggregates, produces mixes that can be immediately compacted without requiring aeration and develops high early cohesion after mixing. A mixing grade emulsion containing approximately 60 percent asphalt, a volatile solvent, water and emulsifiers, Bitumuls SM-K has excellent pumping and storage stability and can be mixed with dry aggregates without the addition of water. Mixing stability is such that the emulsion breaks during the mixing cycle permitting the volatile solvent to assist in coalescence of individual emulsion particles.

American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif.

Circle No. 7-9 on the convenient reply card facing page 34.



Tamper

The Dynapac CM-10 vibratory tamper travels at speeds up to 90 ft. per min. A throttle lever provides the operator with control over all speeds. A centrifugal clutch enables the unit to idle in place. The engine is spring mounted. The Model CM-10 weighs 290 pounds, has an impact of 3600 lbs. at 4500 VPM and has an adjustable frequency up to 4500 VPM.

Vibro-Plus Products, Inc., Stanhope, N. J.

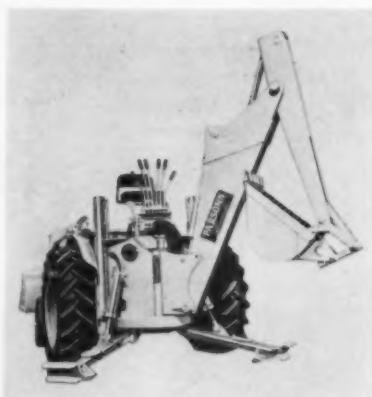
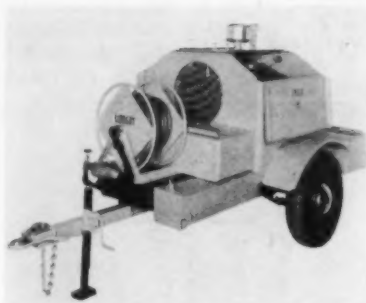
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Air Compressor

These radial type air compressors, 30 to 125 c.f.m. models, have been re-designed to assure portability, ease of servicing, and twelve-volt starting systems on all models. The Lindsay air compressors are all direct-drive design and are equipped with air-cooled four-cylinder Wisconsin engines. They may be moved by one man or towed at regular automobile speeds. Other features include an adjustable speed governor and automatic unloading with engine slow down.

P. K. Lindsay Co., Inc., 97 Tilton St., Everett 49, Mass.

Circle No. 7-11 on the convenient reply card facing page 34.



Backhoes

Three Parsons-Shawnee backhoes for utility tractors include the 1000, with a digging capacity of 10-ft. deep; the 12-ft. 1200; and the 13-ft. 1300. These backhoes feature "Hyd-away" hydraulics with cylinders, pistons, and hoses enclosed and protected (all models except the 1000); 3-position dig-all bucket; non-skid stabilizers; safety locks on both boom and swing; multiple series control; rubber stops on frame to cushion against swing mechanism; and full 180° swing. Each of the attachments fits on all popular makes of utility tractors, both new and used.

Parsons Co., Shawnee Dept., Newton, Iowa.

Circle No. 7-13 on the convenient reply card facing page 34.

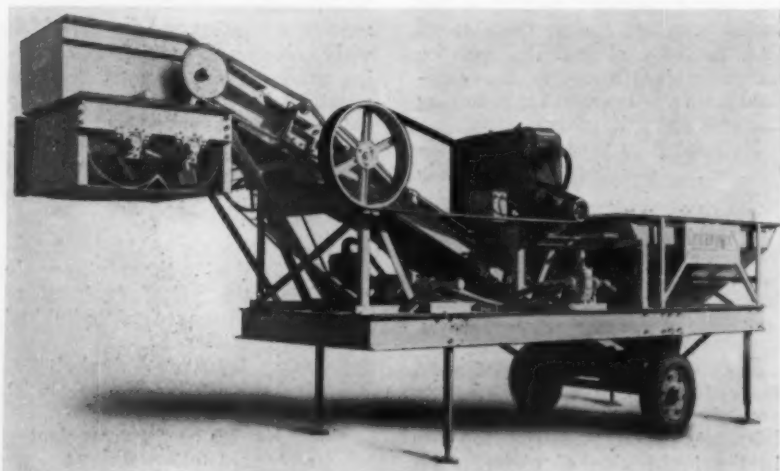
Base Mixer

Five stabilized base mixer Models 1A, 1B, 1C, 1D and 2A are compact highly portable units with either single shaft or twin shaft pugmills. All have 6½-cu. yd. bins with a long side dimension for ease of loading with a front-end loader. A 4½-cu. yd. bin extension is optional as is an extension with a 2" grizzly

for rejecting oversize material. All models have provisions for adding calcium chloride or soil cement feeders and an asphalt emulsion attachment.

Iowa Manufacturing Co., Cedar Rapids, Iowa.

Circle No. 7-12 on the convenient reply card facing page 34.

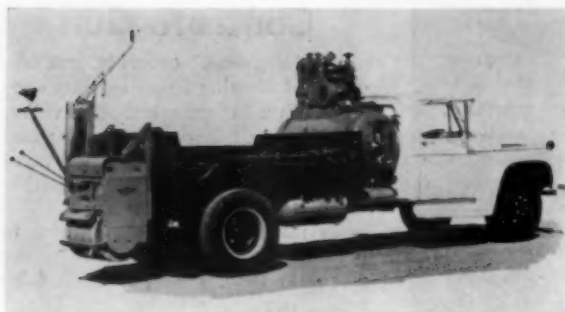


Photoelectric Control

The quick response photoelectric control, designed for outdoor lighting applications, is built around General Electric's cadmium-sulphide photoelectric cell. This cell is combined with a simplified circuit and a minimum of components to assure reliability and troublefree operation. The control, designed for any lighting application where extended time delay is not desired, functions automatically and efficiently to give precise control of any lighting circuit or of individual luminaires. The control will switch up to 1,000 watts incandescent load or 1,800 volt-amperes mercury vapor or fluorescent load and is available for either 120 or 240-volt operation.

General Electric Company, Schenectady 5, New York.

Circle No. 7-14 on the convenient reply card facing page 34.



Patch Unit

The Patch Force unit consists of a specially-built dump truck which includes all of the street maintenance equipment needed by a maintenance crew. In addition to the two-ton truck and dump body the following items are utilized: a truck-mounted combination 200-gal. emulsion sprayer; an air compressor of 45 or 58-cu. ft. capacity; 7-ft. combination air atomized or straight pressure emulsion spray

gun with 3 spray tips; a 28" self-propelled high frequency vibrating roller with carrying hooks for hanging the roller on the tailgate of the truck; a portable asphalt surface heater and L/P gas tank and hose; and a 60-gal. air pressure type water tank with fittings.

Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles 21, Calif.

Circle No. 7-15 on the convenient reply card facing page 34.



Distributor

The Spray Master distributor has been designed to provide special engineering features including: Single handwheel control; patented shot meter (dial the rate of application desired anywhere from .075 to 3.0 gal. per sq. yd.); patented bar meter located on operator's control panel; torque limiter hi-low flues to permit heating small quantity of material; and "Uniflo" full circulating spray bar which provides even starts and instant shutoff.

Littleford Bros., Inc., 457 East Pearl St., Cincinnati 2, Ohio

Circle No. 7-18 on the convenient reply card facing page 34.

Pressure Cleaner

A self-contained, electrically-powered and electrically-heated high pressure cleaner for automobile bodies, engines, parts, machinery, equipment, trucks, floors, etc., the Jenny Multi-Job washer produces a degreasing or cleaning spray of 25 gallons per hour at 300 pounds pressure and 100 degree rise in solution temperature; or a wash-rinse spray of 90 gallons per hour at 250 pounds pressure and 25 degree rise in solution temperature. It has a float controlled water supply tank for continuous operation. The unit is offered in portable or stationary models.

Homestead Valve Manufacturing Co., Coraopolis, Pa.

Circle No. 7-16 on the convenient reply card facing page 34.



Hydraulic Hoe



This Model 110 hydraulic backhoe built for use with Caterpillar Models 922, 944 and 966, wheel-type loaders, is fully hydraulic and can be snapped on or off in less than a minute, without any tools. Other major features include 180° continuous swing, and 180° bucket tilt. The unit has a 12' 4" digging depth, 10,000-lb. breakaway at bucket teeth, and 15½-ft. reach from center of rotation. Outriggers are individually controlled and a turret type operator's seat is offered. Exclusive quick-change buckets are used.

Badger Division, Warner & Swasey Co., 1124 West 5th St., Winona, Minn.

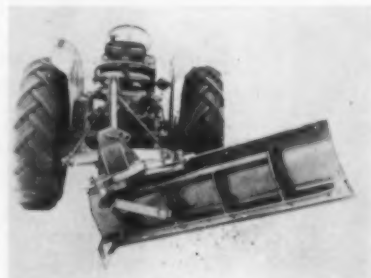
Circle No. 7-17 on the convenient reply card facing page 34.

Utility Blade

A heavy-duty utility blade, the Model AB-12 tractor mounted utility blade offers advantageous features in snow and earth removal. The unit offers a choice of 5 tilt and 4 pitch adjustments, 7 angular positions forward, 3 angular positions reverse and offsets 15" to left or right for close work near fences or buildings. The entire unit is reversed by simply lifting lock pin and rotating blade and is designed for interchange with 6' or 8' landscaping and/or rock rakes. Optional equipment includes ditching point, end extensions, side plates, skid shoes and gauge wheels.

Arps Corp., New Holstein, Wisconsin.

Circle No. 7-19 on the convenient reply card facing page 34.





Pedestrian Gate

Traffi-Trol Safety Gate covers a full lane of traffic, looks like a railroad crossing gate, and weighs 8 lbs. The advantages of these school-monitor operated devices include: child gate operator never leaves sidewalk; positive curbing of pedestrian traffic; a safety path to protect

children as they cross the street; a stop sign for motorists; averting necessity of sign removal after school hours.

Traffi-Trol Safety Gate Co., 537 Sixth Ave., Steubenville, Ohio.

Circle No. 7-20 on the convenient reply card facing page 34.

Cat Tractor

Combining a 15 percent horsepower increase with basic improvements to the power shift transmission to increase production capability, the series Cat D9G tractor incorporates major advances in power train and final drives with a redesigned track roller frame to retain long service life under severe pushing, dozing and ripping applications. Overall adaptability is improved by three hydraulically-boosted cable controls and arrangements of three different hydraulic controls. The tractor's 385 flywheel horsepower rating results primarily from a system of controlled turbocharging with aftercooling of intake air. Attachments for the D9G include the No. 9C bulldozer with either single cylinder hydraulic or cable control. A cushion push block is available

for the D9G for tandem pushing applications. The No. 9 Ripper, featuring five position clevis and quick change shank and tip pin retainers, permits high production at low cost. Three bulldozers, 9A, 9S and 9U, are available with either hydraulic or cable controls.

Caterpillar Tractor Co., Peoria, Ill.

Circle No. 7-21 on the convenient reply card facing page 34.

Water Plant

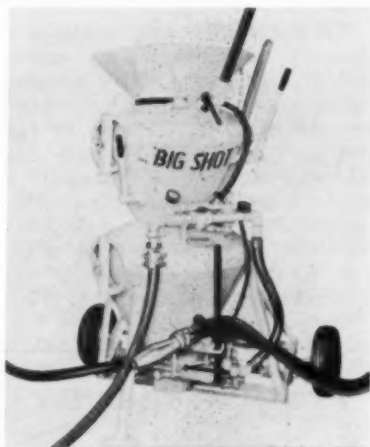
A prefabricated plant is being offered to provide surface water treatment, iron removal or softening for small installations. The unit, called the "Rotoflow," includes facilities for mixing chemicals, coagulation and filtration. Automatic operation is achieved by the use of an inlet valve controlled by water level and a backwash valve actuated by backwash pump pressure. Periodic replacement of chemicals and inspection to assure proper adjustment of chemical feed constitute the only operating attention required. The units can be purchased in 13 sizes, varying in capacity from 300 gph to 6,000 gph. Larger sizes can be designed for field erection.

Northwest Filter Co., 528 S. Holden, Seattle 8, Wash.

Circle No. 7-22 on the convenient reply card facing page 34.

Concrete Gun

The "Big Shot" concrete gun offers the following features: fast cycling with a 15" spherical slide valve; large 5 cu. ft. hopper capacity; and in-line fog oiler and simplified valve action result in smooth operation with minimum maintenance. The large manhole-type access doors to both upper and lower chambers cut clean-up time. Powered by a 4-hp rotary vane air motor and heavy duty gear box drive, the concrete gun maintains its production rate



with the coarsest materials.

Air Placement Equipment Company, 1000 W. 25th St., Kansas City 8, Missouri.

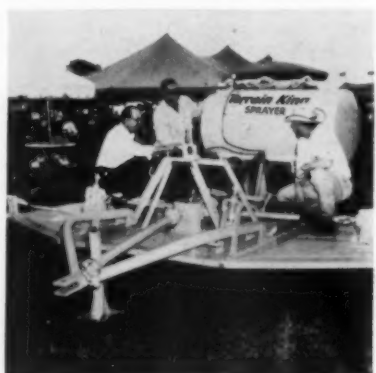
Circle No. 7-23 on the convenient reply card facing page 34.

Sprayer

A spraying attachment for the 15' Terrain King mower mounts on and trails behind the flexible mower to combine spraying with mowing. The user can fertilize as he mows to reduce the cost of both operations.

Engler Mfg. Corp., 4407 Center St., Houston, Texas.

Circle No. 7-24 on the convenient reply card facing page 34.



Riding Tractor



The 1961 Beaver riding tractors designated Model 750 and 750E offer styling and engineering features resulting in long operating life, streamlined appearance and handling comfort for the operator. The Beaver is an all-seasons grounds maintenance tractor and can be used 12 months of the year for a variety of applications from general grounds and lawn maintenance to snow removal and light hauling. Eighteen attachments are offered including a rotary mower, dump cart, side sickle bar, triple gang mower.

The Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.

Circle No. 7-25 on the convenient reply card facing page 34.

Pump Strainer

A pump strainer, the "Suction King" for sump pumps and portable dewatering pumps permits withdrawal to within $\frac{1}{2}$ in. of the floor level. Construction is in the form of a flat box, $10\frac{1}{4}$ " by $14\frac{1}{4}$ " by 1", with the sides and bottom of 20-gauge steel with $\frac{1}{4}$ " perforations. The units may be obtained with a base with threaded suction connection flange; with base, flange and street-ell; or with base, flange, street-ell and brass coupling. Flange, street-ell and coupling sizes are $1\frac{1}{2}$ ", 2", $2\frac{1}{2}$ " and 3".

Hawley Mfg. Co., 92 Joyce Road, Tenafly, N. J.

Circle No. 7-26 on the convenient reply card facing page 34.



Crawler Tractor

The International TD-15 (151 series) crawler tractor, intermediate representative of the International-line crawlers, is powered by a six-cylinder D-554 diesel engine which develops 105 engine hp at 1,650 rpm. Drawbar hp is 85, with a 23,750-lb. maximum drawbar pull with adequate weight and traction. The crawler features in-built, gasoline-conversion, push-button, all-weather starting of the four-cycle, valve-in-head type engine and a full-reverse transmission, with six speeds forward and six in reverse. Forward speeds range from 1.5 to 5.9 mph.

International Harvester Co., 180 North Michigan Ave., Chicago 1, Illinois.

Circle No. 7-27 on the convenient reply card facing page 34.



Mapping Projector



The Balplex 120 mapping projector offers complete portability, for use either in headquarters or mobile, field units, with highest quality precision optics protected by durable mountings. The 120 degree projector is expected to serve many needs of construction and engineering outfits and government units for producing highly precise topographical maps. The lenses have high resolving power, are uniform in the distribution of light intensity, and free from distortion.

Photogrammetric Section, Bausch & Lomb Inc., Rochester 2, N.Y.

Circle No. 7-28 on the convenient reply card facing page 34.

Refuse Packer



The Converto Packer, available in 20, 30 and 40-yard capacity, features a front loader system capable of carrying its own container for door-to-door collections or, without any adjustments, picking up and dumping standing containers. The loader is rated at 3000 pounds capacity. The Packer carries its pickup container at ground level, for easy filling by route men, then swings

it up and into an opening in the body for emptying and safe transport on the road. Compaction, inside the steel body, is handled by a steel blade, propelled in a front-to-back direction by two hydraulic cylinders. All operation is hydraulic.

Converto Mfg. Co., Cambridge City, Ind.

Circle No. 7-29 on the convenient reply card facing page 34.

Vacuum Cleaner



A vacuum cleaner mounted on a trailer makes possible removal of leaves, waste, litter, paper and other debris. The machine is convertible with engine, nose cone and exhaust removed to permit the trailer to be used for other purposes. Model 666 features a 3-hp engine, trailer with 48" x 34 1/4" outside dimensions and 32" nose cone. Model 999 has 5 1/4-hp engine, 60" x 40" trailer and 40" nose cone. Backboard, posts and screen to enclose the trailer are available.

Giant-Vac Manufacturing Co.,
South Willington, Connecticut.

Circle No. 7-30 on the convenient
reply card facing page 34.

Soil Tester

A push-button nuclear device for making rapid measurements of the density and moisture in soils, aggregates and pavements, the Hydro-Densimeter, will permit inspectors to take a reading of both the moisture and density of material being compacted, in 60-seconds. A series of three readings to verify uniformity of these conditions take less than 5 minutes. The electronic device is expected to be in great demand by both contractors and inspectors on highway, airstrip and dam work and on other construction projects. The system has only two components and employs a radio-active material the use of which does not require licensing by the Atomic Energy Commission. It is composed of two parts—a probe and a counter. The probe (8" x 3" x 14"), containing a radio-active material (radium-beryllium), is placed flat on the surface of the compacted material where it radiates to the depth desired.

Viatic Division of Tellurometer, Inc., 206 Dupont Circle Building,
Washington 6, D. C.

Circle No. 7-31 on the convenient
reply card facing page 34.

Steel Post Anchors

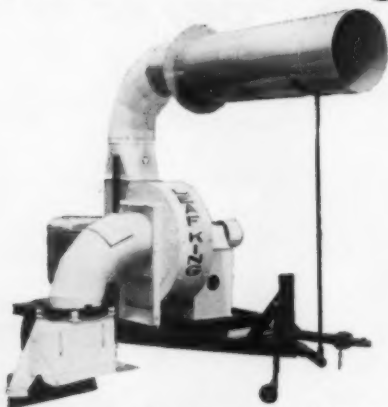


Tri-Set steel post anchors can be used to erect posts for street signs, traffic signs or parking meters in a few minutes time. Post can be quickly removed and reinstalled or raised and lowered. Installation involves driving post to predetermined depth; positioning anchors inside lock ring around post; tilting and driving anchors; and tightening lock ring to secure anchors to post.

National Fence Products, Inc.,
4620 W. 54th St., Chicago 32, Ill.

Circle No. 7-32 on the convenient
reply card facing page 34.

TARCO "Leaf King"



a Big, Powerful Vacuum Collector

The Tarco "Leaf King" has: 1. a large, water-cooled engine with built-in clutch . . . 2. a 36" wide, swivelling and shock-resistant shroud . . . 3. a replaceable steel innerliner in big suction case . . . 4. NO wearable hose in suction or exhaust line . . . 5. a unique, flexible and quick-connecting exhaust line to truck mounted box.

Fast and Efficient for big volume collection of leaves and litter.

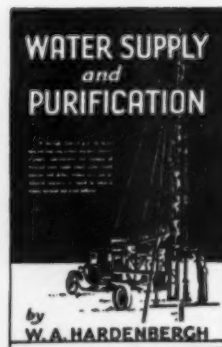
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NEWS OF ENGINEERS

ROLF ELIASSEN will become professor of Civil Engineering at Stanford University, Palo Alto, Calif., effective this fall. He has been Acting Head of the Department of Civil and Sanitary Engineering at Massachusetts Institute of Technology.

E. L. BEBB, long time engineer for Westinghouse Electric has joined the staff of Henningson, Durham and Richardson, consulting engineers of Omaha, Nebr.

UEL STEPHENS, Director of the Fort Worth, Texas, Water Department for 19 years, retired in March and has been succeeded by W. R. HARDY, Assistant Director.

GEORGE L. SODEMAN of Sodeman & Associates, Champaign, Ill., has been elected president of the Illinois Assn. of Consulting Engineers; RICHARD L. THACKER of Thacker Engineering, Waukegan, is vice-president.

N. JACK BURRIS is the new chief of the Water supply section of the Kansas State Health Department. This position was formerly held by Russell L. Culp, now with Cornell, Howland, Hayes & Merryfield of Corvallis, Oregon.

MARSDEN C. SMITH, recently retired Chief Engineer of the Department of Public Utilities of Richmond, Va., has become a consultant to Whitman, Requardt & Associates, consulting engineers of Baltimore, Md.

FRANCIS S. FRIEL, consulting engineer of Philadelphia, has been awarded the honorary degree of Doctor of Science by Villanova University.

Stanley Engineering Co., Muscatine, Iowa, has been incorporated and eight key engineers have been brought into the corporation. They are: F. H. BRECKENFELDER, A. H. DUNTON, A. O. GARVIK, H. L. GODEKE, E. C. LISTER, M. W. SEDGLEY, R. H. STANLEY and B. L. STURDEVANT.

KENNETH K. KING and DONALD J. ADAMS have formed the consulting engineer firm of King & Adams, with offices at 1535 W. Virginia Ave., Phoenix, Ariz. Mr. King was previously Director of Public Works of Phoenix and Mr. Adams was with Russell & Axon in Florida.

CLASSIFIED

SUPT. OF STREETS

Superintendent of streets is wanted for the Town of Speedway, Indiana, home of the 500-mile race. Must be experienced in construction and maintenance of city streets. Familiarity with construction or maintenance of sanitary and storm sewers required. Under 50. Salary range, \$465.00 to \$520.00.

Send resume and photograph to:

Town Engineer
1450 N. Lyndhurst Dr.
Speedway 24, Indiana

CITY ENGINEER

Metropolitan community of 25,000, Winona, Minn. All phases of municipal engineering. Experience, registration required. Salary open.

Apply to:

Roy G. Wildgrube
City Clerk
City Hall
Winona, Minn.

Assistant City Engineer

The City of Chattanooga, Tennessee is accepting applications for the position of Assistant City Engineer with general knowledge of principles and practices of Civil Engineering related to municipal work; should be registered professional engineer or be able to obtain registration for the State of Tennessee. Salary start, \$610.00 to \$640.00; range to \$760.00 per month. Write to:

Ellis L. Spencer
City Engineer
204 City Hall
Chattanooga, Tennessee

CITY ENGINEER

The city of Liberty, Missouri, is seeking a City Engineer. Population 9,000. Desire Civil Engineer graduate with recent experience in Municipal Engineering, registered in the State of Missouri. An unusual opportunity with salary based on experience.

Send detailed resume to:

C. Howard Clark
City Councilman
717 Hillside
Liberty, Missouri

SUPT. OF BUILDING

Supt. of building is available. Administration building department, zoning administrator. Experienced in all phases of public works and municipal government. Age 57. Present salary \$7,000.

Write to:

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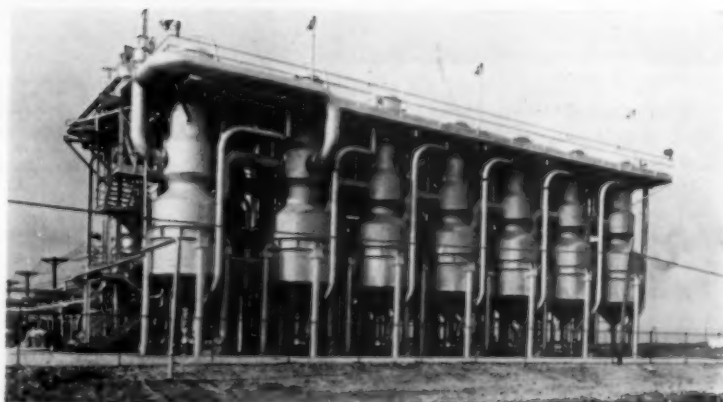
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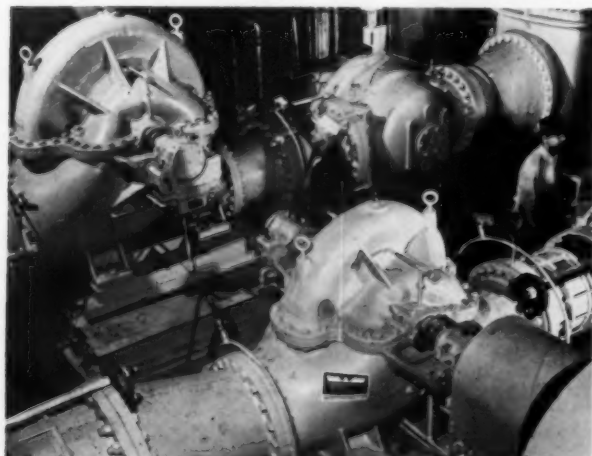


Pedestrian bridge with unique spiral approaches was designed by the Iowa State Highway Department for student traffic on the University of Iowa campus. Circular ramps solved problem of limited access land. Aluminum railing was fabricated by Howe Engineering Company.

The search for fresh water from the sea moved forward with completion of design production tests at the federal government's first experimental conversion plant. View shows 12 evaporators, key units of the new 1 mgd facility built by Chicago Bridge & Iron Company.



More than 50 million gallons of water per day can be pumped by these two Worthington horizontal pumps installed in the new Potomac River water filtration plant of the Washington Suburban Sanitary Commission. The plant cost \$6.3 million.



The one millionth cubic yard of concrete has been placed in the Glen Canyon Dam. On completion the concrete-arch dam will have a total volume of almost 5 million cu. yd. and a height of 710 feet.

Roger E. Risley, vice president and director of engineering, Dresser Mfg. Div., Dresser Industries, became Assistant Director for Mobilization Planning, Water and Sewerage Industry and Utilities Division of the BDSA, Washington.





How much dust would a dustlady dust if a dustlayer didn't lay dust?

—Bob Sproule

ABOUT ONE stroke. Then she'd call the Road Commissioner. Isn't that the way it goes?

Psychological war, that's what it is. And there's only one answer to it. Preventive war. Settle the dust *before* the housewives raise the roof.

You'll keep the peace . . . but you'll do more than that. You'll preserve the road.

After all, dust is just the top of the road taking a powder. It's a loss of material that costs money. It's a loss that regular treatment of roads with chloride can prevent.

Actual highway department records show that, over a period of years, the cost of calcium-chloride treatment often is no more—and sometimes is less—than the cost of replacing lost road material. Another point: Chloride treated roads require less blading . . . 90% less, according to many highway department reports.

Think about it. Well-timed application of chloride is good diplomacy . . . and good maintenance. Wyandotte Chemicals Corporation, Wyandotte, Michigan. Offices in principal cities.

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MICHIGAN ALKALI DIVISION
HEADQUARTERS FOR CALCIUM CHLORIDE



by Arthur K. Akers

★ **Art Parchen**, advertising manager, Smith & Loveless Div., advises us of the "Certificate of Merit" awarded his company's 4-color advertisement in our 1959 **SEWERAGE MANUAL** and Catalog File. Get out your **MANUAL** and look at it again!

★ **Robert H. Bjorklund** moves up from executive vice-president to president, Lyle Signs, Inc., Minneapolis.



Mr. Bjorklund



Mr. Owen

★ **Nichols Engineering & Research Corp.**, New York, consolidates its Filtration, Refuse Incinerator and Sewage Sludge Divisions into a "Public Works Equipment Division" under Vice-President **Mark B. Owen**. Mr. Owen is a past president of the American Public Works Association. Nichols also appoints **H. Bach Nielsen** as assistant general manager.

★ **U. S. Pipe and Foundry Co.**, Birmingham, opens a sales office in the Snyder Sq. Building, Buffalo, N. Y., under **Joseph T. Donahue**.

★ **E. E. Cone** moves up from head of WEMCO engineering department to head the WEMCO Div. Pump Department of Western Machinery Co., San Francisco.

★ **Thomas R. Komline**, president of Komline-Sanderson Engineering Corp., Peapack, N. J., was cited by U. S. Secretary of Commerce **Luther H. Hodges** for his work as an industrial mobilization aide on temporary loan to the Department. As a memento, Tom received also an American flag which had been flown over the Capitol.

★ **FMC Corporation** is the new name of Food Machinery & Chemical Corp. In the public works field this includes Chicago Pump, Peerless Pump, John Bean and Bolens Divisions.

★ **Lewis J. Burger** heads LeTourneau-Westinghouse Co. as president, succeeding **Merle R. Yontz**, now with Caterpillar Tractor Co.

★ **J. I. Case Co.** names **D. A. Milligan** to the new post of general manager, Marketing and Product Development; **J. P. Cody**, general sales manager, Industrial Div.

★ **Chicago Bridge & Iron Co.** elects **M. G. Mitchell**, senior vice-president and manager of sales. **J. T. Horton**, **H. J. Clarke**, and **S. C. Hamilton** are other new vice-presidents.

★ **Boyd S. Oberlink**, a vice president of Allis-Chalmers Mfg. Co., is announced as chairman of the Administrative Committee for the 1963 Road Show in Chicago.

★ **Neptune Meter Co.** announces their new Chicago office and warehouse, in Elk Grove Village, a suburb. **William Haendel** remains district manager.

★ **Centriline Corp.** has opened a West Coast office at 816 West Fifth St., Los Angeles, to serve seven western states, with **James E. Wolfe** as district manager.

★ **Norman Gahnz**, vice-president, sales, for Wausau (Wis.) Iron Works, is named vice-president and general manager.

★ **Simplex Valve & Meter Co.** announces **Franklin L. Sommer** has rejoined their sales force as district manager, Philadelphia area.

★ **Customer**: "To what do you owe your extraordinary success as a house-to-house salesman?" Sales shark: "In the first five words I utter when a woman opens the door; 'Miss, is your mother in?'"

—N. D. Coarse Screenings

PUBLIC WORKS for July, 1961



OC-46 backhoe-loader does everything but engineer the job and make the pipe!

Versatile Oliver crawler uses backhoe to dig trench... bucket with simply rigged boom and tackle to lay the pipe... $\frac{3}{4}$ -yd. bucket for backfilling and

then back-blading. Note how the low mounting and clean lines of the loader frame give the operator unobstructed view of the work.

Know more about these tricky points before specifying a backhoe-loader

Extraordinary success of Oliver OC-46 crawlers points up need for public officials to approach machine selection with a new outlook.

Spec for spec, the OC-46 seems to be only one of several sound buys in the small crawler field. However, on the job, it consistently handles a wider range of work, substantially outperforms anything in the class. How come? Here are just three areas in which specifications may not lie but can be expensively misleading.

CAPACITY: Using bucket size alone as a guide is a mistake. Most loaders offer many buckets for each model. Result—there's a temptation to use a rig on jobs that its engine, transmission, tracks, hydraulics and components are not designed to handle.

The Oliver OC-46 is the only crawler in its work range built from the beginning for construction and utility service—not converted to it. It is built with a loader frame designed to handle a $\frac{3}{4}$ -yd. bucket, a backhoe engineered to dig to 12 ft., 8 inches. Each OC-46 component is strength factored to function in balance with the others... give you bonus years of high performance at low upkeep despite rugged work, heavy schedules.

POWER: Here, too, it's easy to be misled. Rated hp is only relative. There's displacement, governed rpm and torque to be considered. Small engines can be run at "gut-cooking" high speeds to inflate power rating. On the other hand, engines that are perfectly adequate in themselves may not have the transmissions and structural strength to fully utilize the engine's power.

Powered by a 130-cu.in. displacement gasoline or diesel engine, the OC-46 is conservatively rated at 30 hp when run at 1700 rpm—a speed well within its recommended optimum limits.

Thus, it's an easy-working and consequently long-lived engine with plenty of power in reserve—an engine with exceptional lugging power. Yet it's an engine that is not an overmatch for the rest of the unit. On the job, the OC-46 delivers upwards of 5000 lbs. of drawbar push or pull for excellent crowd and/or breakout.

PRICE: Here's another area of confusion. You might think you're buying the lowest price unit but by the time you add the extras you need to get the rig you want—you wind up paying more for it than others.

This stems from the fact that there is no standardized system of pricing that makes comparison easy.

Your Oliver dealer can quote you a single price for ready-to-work unit with all the equipment you need.

Here's our suggestion. Contact your Oliver dealer and he'll arrange to see you at your convenience... fill you in on the considerations that should go into buying a crawler loader... cut through confusing claims, save trouble... even help you write your "specs" if you desire. What's more, he'd be pleased to arrange for an on-the-job demonstration of the OC-46. Call him today. If you don't know where to reach him, write direct and we'll have him contact you.

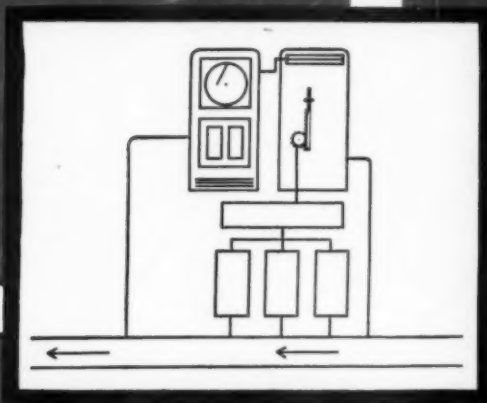
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You can build Compound-loop Control component by component. As the future demands, you can add W&T auxiliary equipment to achieve this closed-loop, information-feedback system, no matter what your present arrangement.

For more information, write Dept. S-140.78



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